Current ISS Model with Continuous Improvement

Baseline - Continuous Improvement Model

Definition

The **Baseline Model** of Utilization Management for the International Space Station (ISS) is the current model and is an element of the NASA government organization. It is dedicated to maintaining the ISS microgravity laboratory in cooperation with our International Partners for science, technology and commercial pursuits.

This model encompasses 21 different functions representing the activities of Utilization Management.

Baseline - Continuous Improvement Model
Purpose

- The objectives and purpose of the Utilization Management are to:
  - Facilitate the pursuit of flight research
  - Optimize research opportunities within current capabilities of ISS and with future enhancements for greater capabilities
  - Increase the long-range productivity of research and development

Baseline - Continuous Improvement Model

Description

The **Baseline Model** of Utilization Management for the International Space Station (ISS) can be further understood through a simplistic illustrated model of the flow of an experiment/payload onto the International Space Station (Figure A).

Figures A-1 through A-3 compare Science, Technology and Commercial payload interfaces, respectively, for ISS implementation.

This flow tracks back to the 21 Utilization Management functions.

Baseline - Continuous Improvement Model
Description

21 Utilization Management Functions

0. Defining and implementing policy and strategic plans
1. Management of research utilization
   a. Implement strategic plans
   b. Manage research programs
   c. Manage integrated research utilization
2. Preparing and allocating budgets
   a. Budget formulation, justifications
   b. Budget execution
3. Selecting and prioritizing research
   a. Managing selection process
   b. Selection
   c. Prioritizing selections
4. Establishing payload/experiment requirements & feasibility
   a. Research requirements
   b. Engineering concepts, development, & hardware assessments

Baseline - Continuous Improvement Model
Description

21 Utilization Management Functions (continued)

5. Developing cost, schedule and risk assessments
   a. Perform cost, schedule, risk management assessment
   b. Authority to proceed
6. Developing and qualifying flight research systems
   a. DDT&E
   b. Subrack integration
   c. Operations
7. Maintaining and sustaining flight research systems
   a. DDT&E
   b. Operations
8. Developing ground systems
9. Maintaining and sustaining ground systems
   a. Identify changes/upgrades in research flight systems
   b. Maintain and sustain research ground systems
10. Constructing ground facilities
11. Maintaining ground facilities

Baseline - Continuous Improvement Model

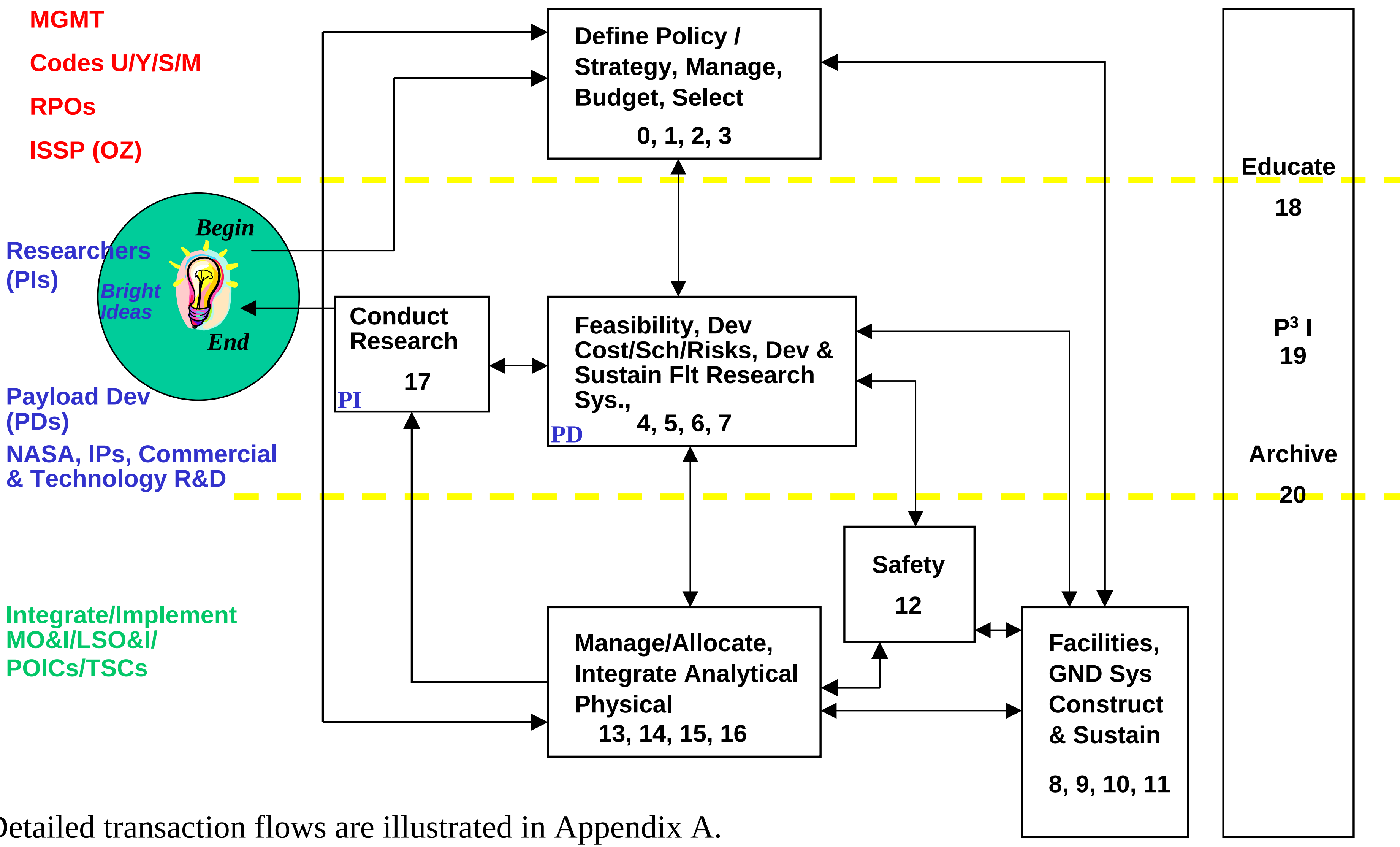
Description

21 Utilization Management Functions (continued)

12. Certifying safety of research flight and ground systems
13. Managing missions and allocating services
    a. Advocacy, manifesting and resource allocation
    b. ISS Research mission management
14. Integrating user missions - analytical
    a. Payload engineering integration
    b. Payload software integration and flight production
15. Integrating user missions - physical
16. Integrating user missions – operational
    a. Payload training
    b. Operations integration
17. Conducting research and analysis and disseminating results
18. Educating and reaching out to the public (including industry)
    a. Management and control
    b. Disseminate, communicate and report results to ISS customers
19. Recommending ISS pre-planned product improvements
20. Managing archival of research samples, data and results

Top Level Flow ISS Utilization

Figure A



•Detailed transaction flows are illustrated in Appendix A.

Figure A Terminology

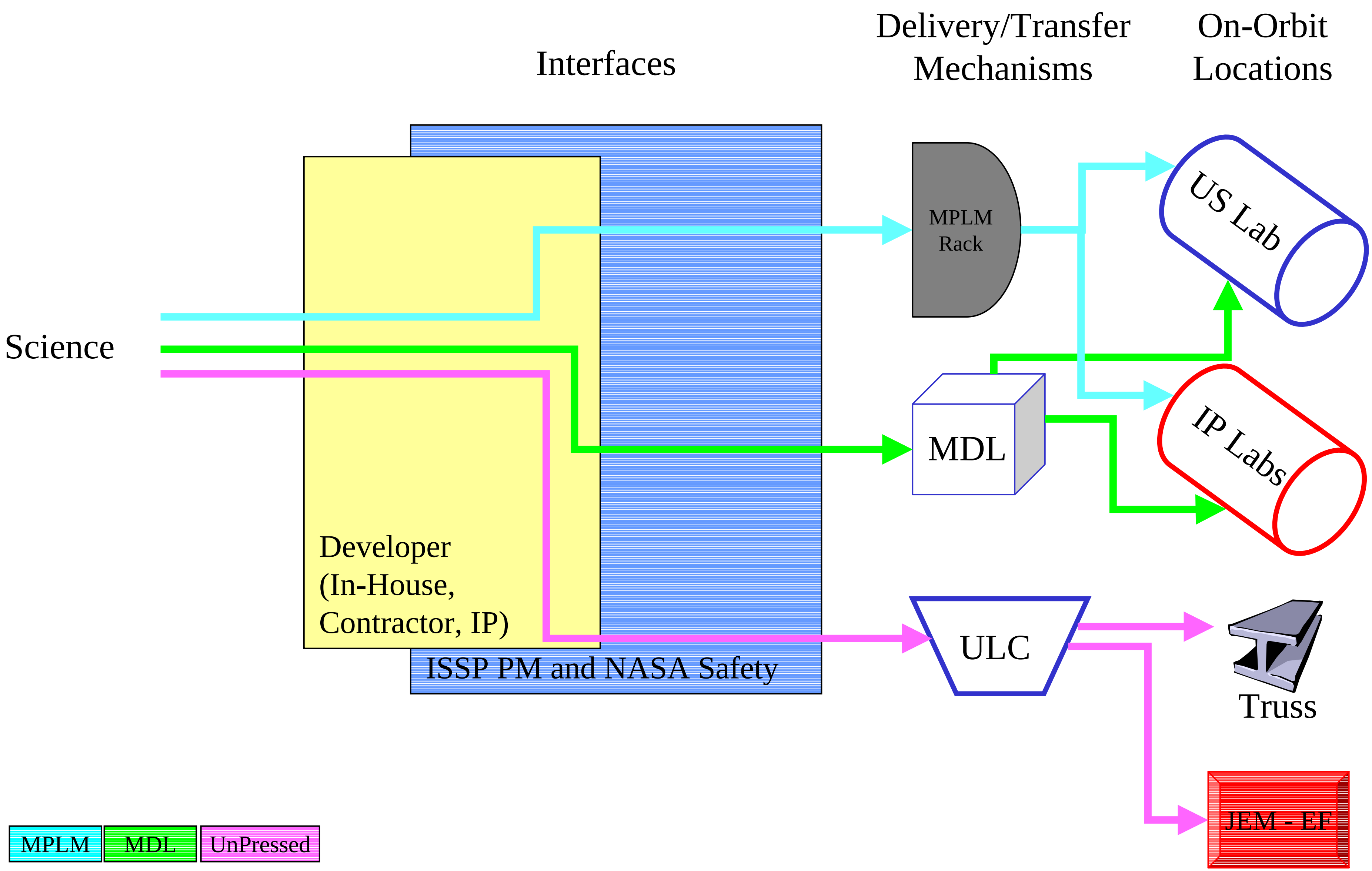
- Principal Investigator (PI): Investigator responsible for the definition of the research and analysis associated with experiments selected to be implemented. The PI may also be the PD
- Payload Developer (PD): Represents and is responsible for a single or a combination of same discipline experiments from project initiation through completion of data analysis
- Research Program Office (RPO): Organization responsible for defining research objectives and priorities for it's assigned discipline, as well as experiment implementation and recommended assignment to a given carrier. (Previously at Field Centers; some have been retracted to HQ as of 09/02.)

Baseline - Continuous Improvement Model
Description

Figure A Terminology

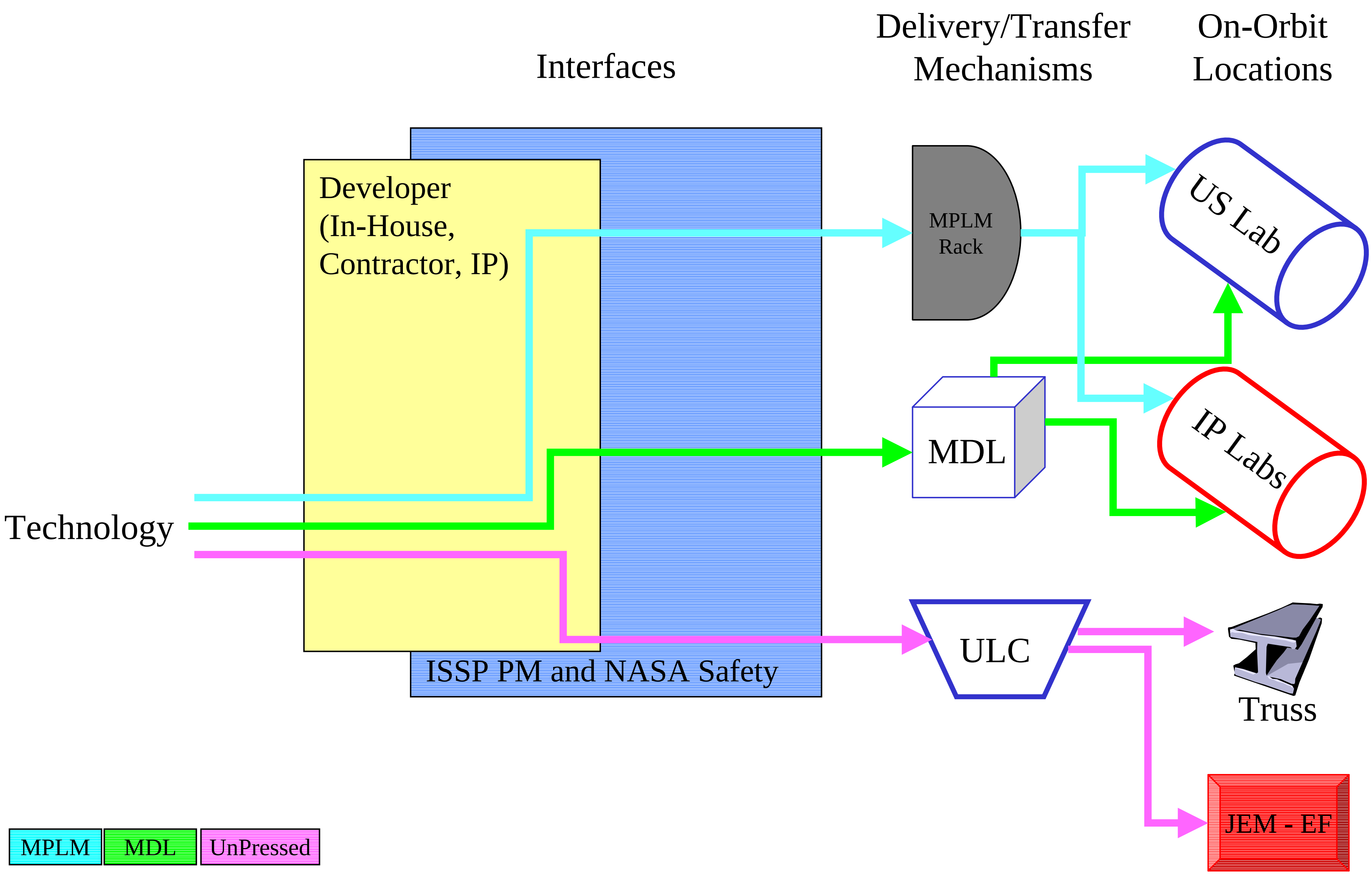
- Management
  - Headquarters proposal announcements and selection
  - Research Program Offices (RPO's) support to HQ
  - Mission Payloads Office (OZ)
    - Organizational relations of this office are further illustrated in charts 8 & 9
    - Payload Integration Philosophy of this office shown in chart 15
- Payload Development
  - Payload Developers (PD's) develop research facilities and experiments located:
    - NASA Centers
    - Commercial Centers
    - International Partners (IP's)
- Integration activities
  - Telescience Support Centers (TSC's) support flight operations for PI/GI
  - ISS Payloads Office Mission Operations and Integration (MO&I)
  - KSC Launch Site Operations and Integration (LSO&I)
  - Payload Operations Integration Center (POIC)

NASA Scientific Payloads Flow
Figure A-1

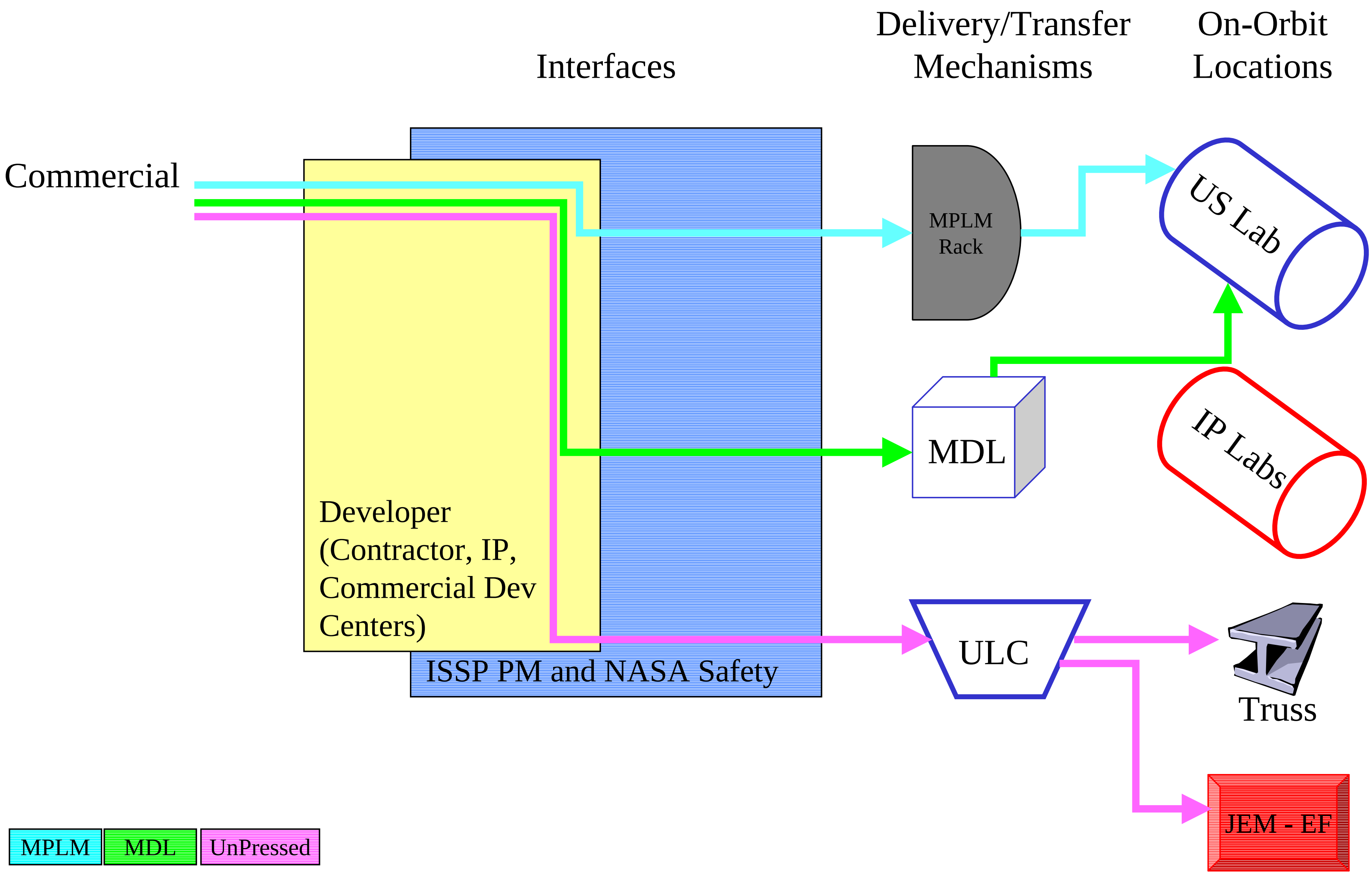


NASA Technical Payloads Flow

Figure A-2



Commercial Payloads Flow
Figure A-3



Baseline - Continuous Improvement Model
Rationale

Rationale for Continuing Current Baseline

- Early Program focus on hardware development and on-orbit assembly
  - Early 2001 Program began operational phase supporting research on-orbit
  - Focus on improvement initiatives began in March 2001 and impact is only recently being realized
- Interruption of current activities could result in:
  - Loss of corporate knowledge of as-built hardware
  - Disruption in relations with customer/researcher community
- Direct interface between NASA and International Partners has proven effective

Baseline - Continuous Improvement Model

Rationale

Rationale and Basis for Baseline

- ISS Payload Integration Philosophy
  - ISS establishes an integration process with documentation structure and Payload Developer support similar to past NASA Programs
    - PIMs are assigned and Integration Agreements and Data Sets are developed
    - Processes incorporate requirements for multiple transfer vehicle(s), carriers, and on-orbit laboratories into one process
    - ISS delegates responsibility for development of operations integration products to the Payload Developer
  - ISS Payloads Office throughout the integration process:
    - Defines the integration products
    - Establishes teams to review and approve the products
    - Provides points of contact to support the PD
  - ISS Payloads Office acknowledges the complexity of the Integration process and has processes and teams in place for continuous improvement

Baseline - Continuous Improvement Model
Rationale

ISS Payload Integration Philosophy(cont'd)

- This philosophy requires the ISS Payloads documentation to cover all scenarios associated with ISS for both ascent and return
  - Pressurized interfaces and carriers:
    - MPLM Racks
    - US Lab Racks
    - ISIS Drawers
    - Orbiter Middeck
    - SpaceHab
    - IP Lab Racks
    - M-01 & M-02 Bags
    - Crew Transfer Bags (CTB)
    - Zero-g Stowage Racks (ZSR)
    - EXPRESS Transportation Rack (ETR)
    - Resupply Stowage Platform(RSP)
    - Resupply Stowage Racks (RSR)
  - Unpressurized interfaces and Carriers
    - Truss Attach Sites
    - Orbiter Sidewall
    - Bay 13 Carrier
    - Unpressurized Logistics Carrier (ULC)
    - JEM Exposed Facility
    - EXPRESS Pallet
    - SpaceLab Pallet (SLP)
    - Orbiter Bay
    - SpaceHab ICC
  - Alternate Launch Vehicles
    - STS
    - Soyuz
    - Progress
    - Ariane Transfer Vehicle (ATV)
    - H2 Transfer Vehicle (HTV)

Baseline - Continuous Improvement Model
Rationale

- This philosophy of management covers payloads of varying complexity that fly on ISS.
- Payload scenario set selection is based on:
  - Experience with payload (has flown or will fly near-term)
  - Knowledge of payload (payload is well enough defined to assess payload flow through model)
  - Manageable number of scenarios (set of payloads can be assessed by all teams in time allowed)
  - Breadth of set
    - Development complexity
    - Payload classification (e.g. facility, subrack/subpallet, experiment unique)
    - Payload developer (International Partner, NASA, commercial)
    - Interface complexity (e.g. hardware/software suites, deployed hardware)
    - Interface location (pressurized verses un-pressurized)
    - Duration of manifest aboard ISS
    - Standard versus non-standard interface
    - International Partner module location(s)
    - Multi-use

Baseline - Continuous Improvement Model
Rationale

- Recommended Payload Scenario Set
  - Facility Class:
    - Space Station Biological Research Project (SSBRP) Suite
    - Minus 80 Degree Laboratory Freezer for ISS (MELFI)
  - EXPRESS sub rack:
    - Physics of Colloids in Space (PCS)
    - Advanced Astroculture (ADVASC)
  - Non-Standard Attached Payload:
    - Materials on ISS Experiment (MISSE)
  - Truss Attached:
    - Alpha Magnetic Spectrometer (AMS)
  - EXPRESS Pallet Payload:
    - Stratospheric Aerosols and Gas Experiment (SAGE) III

Baseline - Continuous Improvement Model
Rationale

Space Station Biological Research Project (SSBRP)

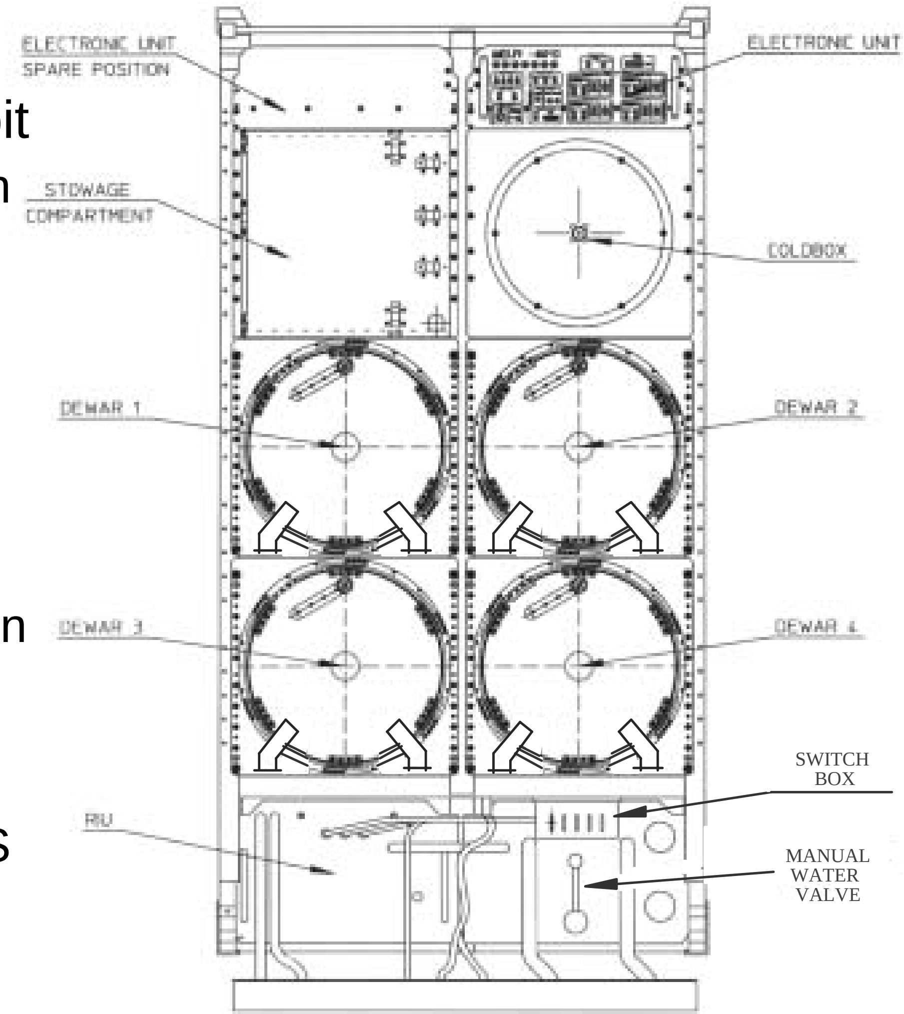
- The Facility consists of a suite of Racks including two Habitat Holding Racks (HHR), the Life Science Glovebox (LSG), the Centrifuge Rotor (CR) and Habitats that are house in them
  - This is a complex set of racks and subracks. The operations concept requires the habitats to be interchangeable between the HHR, LSG and CR which drives up-front integration activity
  - The LSG and CR are developed by NASDA and the HHRs are US developed that requires coordination of development activities
  - HHRs will be launched and installed in the US Laboratory and moved to Centrifuge Accommodation Module
  - SSBRP is a heavy user of conditioned assets on-orbit and in the transport phase
  - The requirement for live animals is unique and must meet minimum requirements
  - Heavily crew intensive requires extensive operational preparation and execution support
  - Life science requirements drive heavy use of the Orbiter Middeck

Baseline - Continuous Improvement Model

Rationale

Minus 80 Degree Laboratory Freezer for ISS (MELFI)

- The MELFI is a three rack series obtained through an international barter that rotate up, down and on-orbit
  - MELFI hardware development (Brayten cycle engine and conductive cooling) was one of the more complex technical challenges
  - MELFI supports Multi-user customer base that have to be integrated and managed in real-time across the increment
  - MELFI is powered on ascent/ descent in Multi-Purpose Logistics Module which requires non-standard interfaces and processes
  - MELFI is designed to operate in the US Laboratory and Japanese Experiment Module system rack location

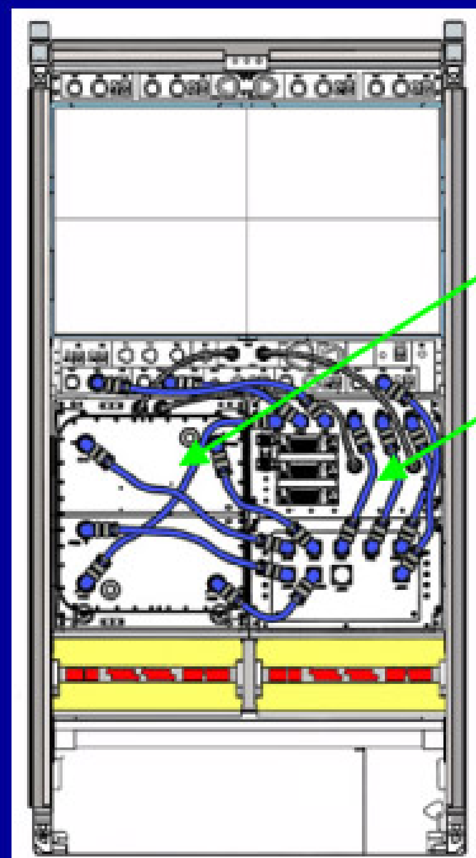


Baseline - Continuous Improvement Model

Rationale

EXPRESS Sub-Rack Payloads - Physics of Colloids in Space (PCS)

- Studies the formations of colloid lattices and large scale fractal aggregates and the physical properties and the dynamics of these formations
- This is a complex EXPRESS payload consisting of multiple lockers communicating with each other and the EXPRESS Rack
- Samples require Early access on return



EXPRESS Rack

- 2 Units each occupying the volume of two Middeck Locker Equivalents.
  - Test Section: Sealed container that holds the 8 colloid samples and all the diagnostic instrumentation.
  - Avionics Section: 2 drawer assembly containing the electronics and software for the power distribution, control, data acquisition and telemetry.
- Mission Operations conducted out of the GRC Telescience Support Center (TSC) with a Remote Telemetry Data Site at Harvard University.
- Long term study of the nucleation, growth and formations of the colloid samples using imaging and light scattering diagnostics.

Baseline - Continuous Improvement Model
Rationale

EXPRESS sub rack: Advanced Astroculture (ADVASC)

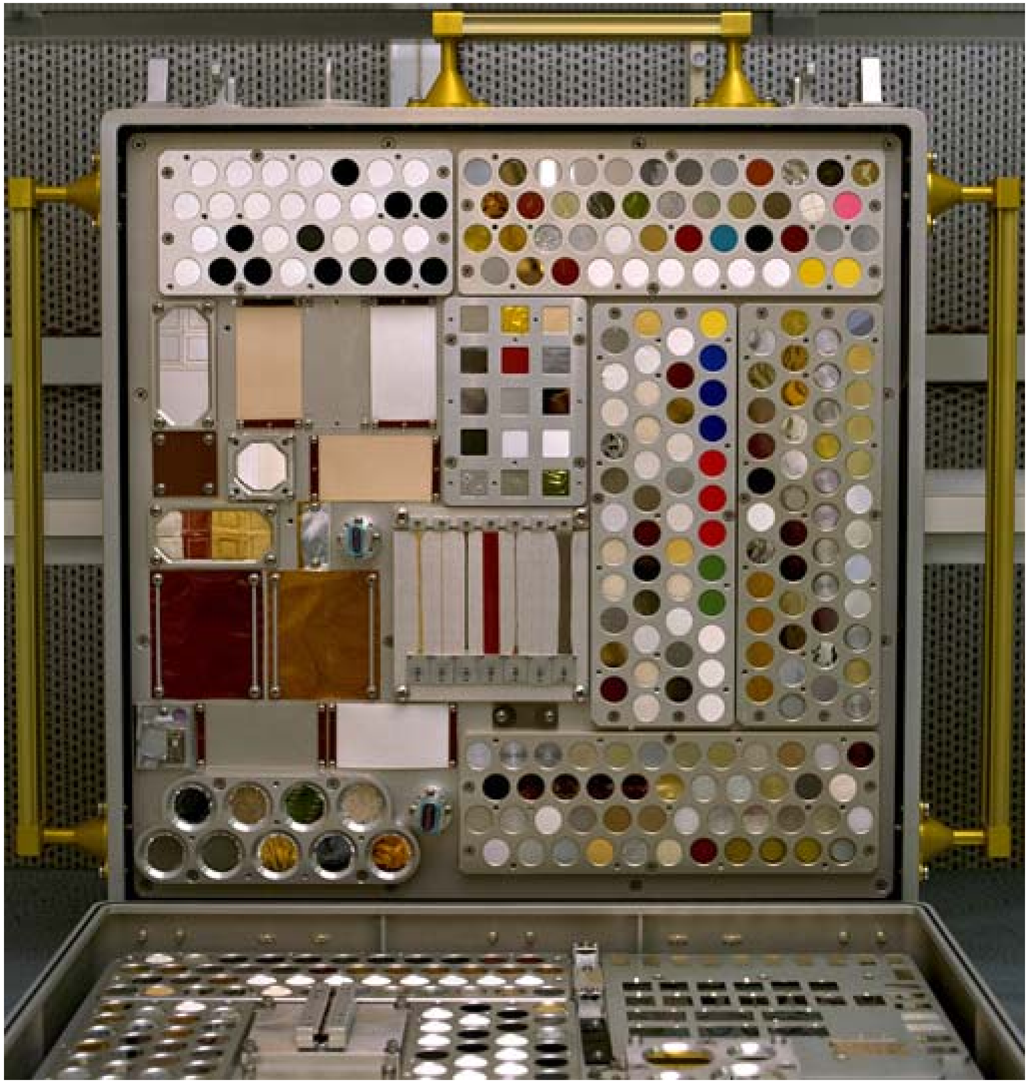
- ADVASC plant growth unit is two single middeck inserts to be installed in an EXPRESS rack
  - One insert, the ADVASC-SS, contains the computer, electronics and other support systems
  - The other insert, ADVASC-GC, contains an enclosed and environmentally controlled plant growth chamber and ancillary subsystems
- Specifically designed without the requirement for transportation power, i.e., ascent and descent power
- Space Product Development sponsored Commercial Payload which has been flown on Increments 2, 4 and 5

Baseline - Continuous Improvement Model

Rationale

Non-Standard Attached Payload - Materials on ISS Experiment (MISSE)

- Non-standard attached payload requires unique ICD and engineering analyses
- EVA deploy/retrieval requires special crew procedures and training
- No crew involvement or resources required once deployed
- Requires unique Flight Support Equipment (FSE) and unpressurized carrier

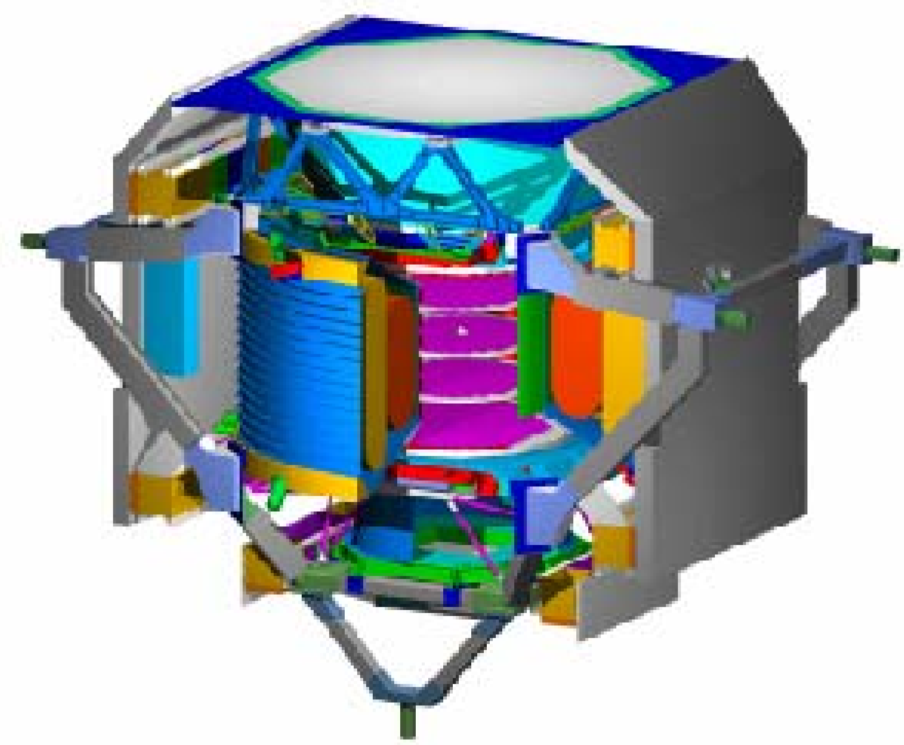


Baseline - Continuous Improvement Model

Rationale

Truss Attached - Alpha Magnetic Spectrometer (AMS)

- Complex development based on the state of the art magnet and component technology, and multi-nation partnership
- Complex integration requires unique engineering analyses (mass/c.g., envelope, magnetic radiation, view to space)
- Complex Shuttle integration of a major cargo element requires coordination with other ISS elements and the Orbiter
- Robotic installation/retrieval integration performed by Mission Operation Directorate not OZ



Baseline - Continuous Improvement Model

Rationale

EXPRESS Pallet Payload Stratospheric Aerosols and Gas Experiment (SAGE) III

- The SAGE III is a complex instrument with a grating spectrometer that measures ultraviolet/visible energy
  - Critical viewing and timing requirements
- Integration made complex with the addition of the HEXAPOD pointing system as part of a barter with ESA
- The instrument is sensitive to contamination due to the ISS environment, particularity during space shuttle visits when contaminant levels are expected to be much higher
- Science requirement to have concurrent data with the SAGE III Meteor 3M mission

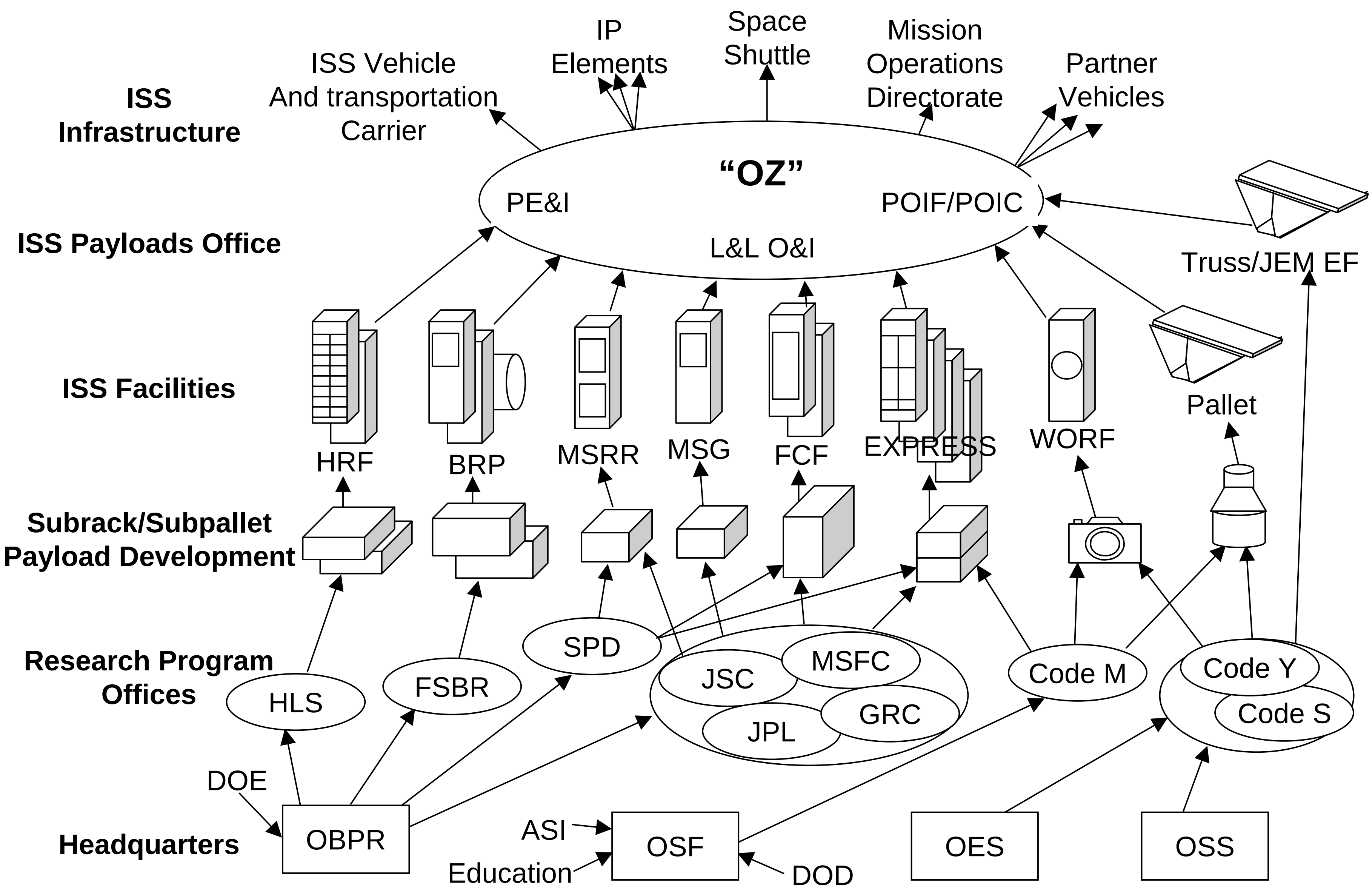
Baseline - Continuous Improvement Model

Characteristics

The current Utilization Management Model is a Program element of NASA, a Federal Agency, and has the following primary characteristics:

- Civil service leadership and management
- Ability to act directly with the International community
- Twenty-one separate functions managed by civil servants supported by contractor teams
  - Technical process/interfaces are illustrated in figure B.
  - Details of interfaces are further illustrated in figures C and D.
  - Contractor support elements are illustrated in figure E.
- Continuous Improvement implementation to focus science prioritization, streamline processes, reduce cost, and minimize interfaces for the User community.

Baseline - ISS Utilization Management Organization
Technical Process and Interfaces (Figure B)

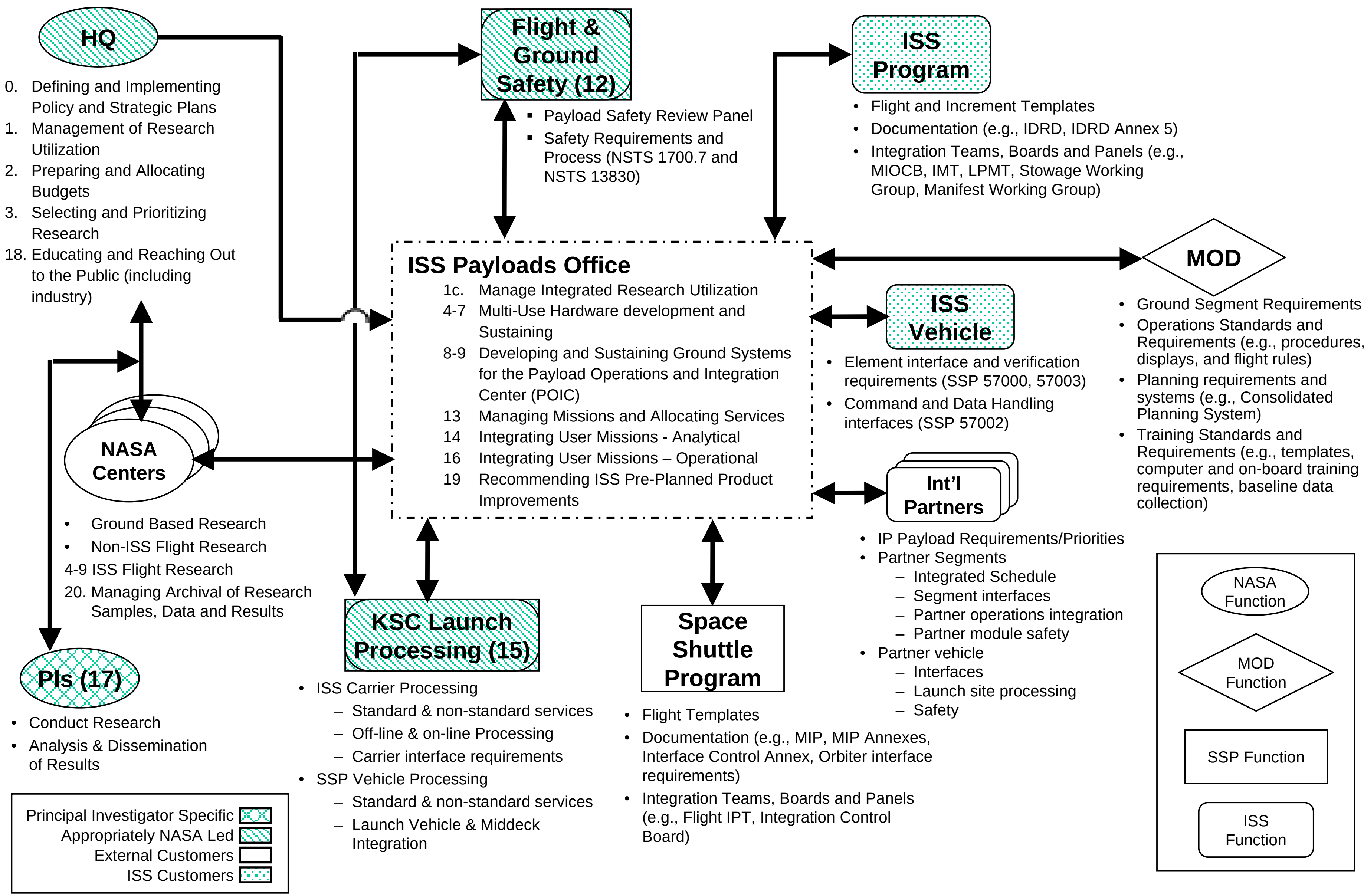


Baseline – ISS Utilization Management Organization

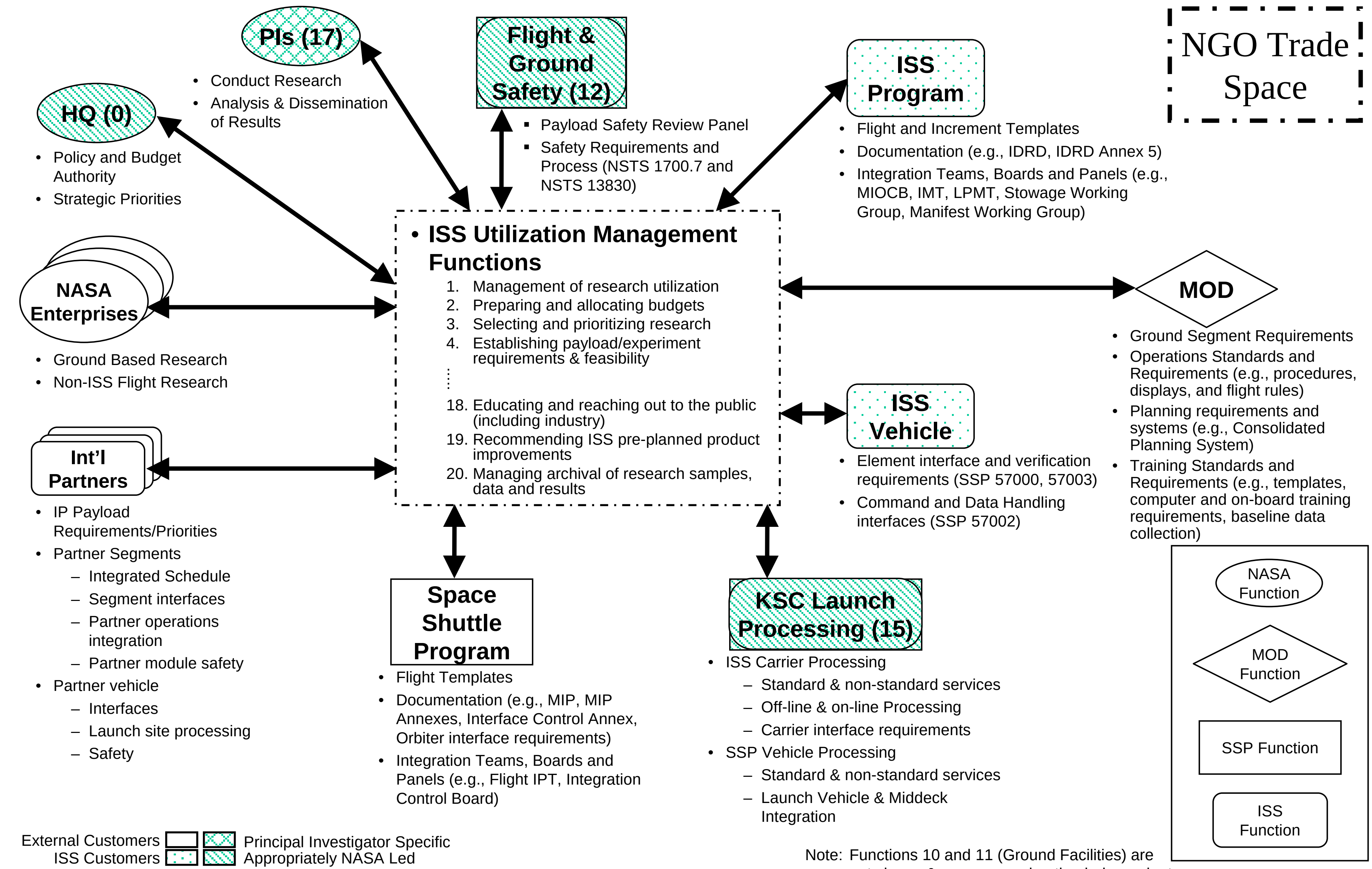
Management and Interfaces

- Figure C illustrates the distribution of the Utilization Management functions across the NASA implementing organizations. It also illustrates the external interfaces that comprise the other elements of the ISS and transportation infrastructure
- Figure D depicts the collected trade space considered by the alternate Utilization Management Organization Options. It also illustrates remaining external interfaces that all options consider

Baseline ISS Utilization Management Organization
Interfaces



Baseline - ISS Utilization Management Organization
Trade Space and Interfaces (Figure D)



Note: Functions 10 and 11 (Ground Facilities) are not shown & are assumed option independent

Contract Support and Agreements

Figure E

- OBPR
  - Global Science Technologies
  - GRC
    - ZIN Technologies
    - Northrup Grumman
    - NCMRFC (Coop Agreement)
  - MSFC
    - Boeing
    - Lockheed-Martin
    - Cherokee Nations
    - Teledyne Brown
    - Hernandez
    - Pace and Waite
    - ASRI
    - CST
    - CSC
    - Infinity Tech. Inc.
    - Boeing
    - AMMSA
    - CortezTechMasters
    - Sverdrup
    - TBS
    - Bd Systems
  - OZ
    - USA
    - Boeing
    - Lockheed-Martin
    - SAIC
  - JSC
    - Lockheed-Martin
    - NSBRI (Coop Agreement)
    - Wyle Laboratories
  - ARC
    - Lockheed-Martin
    - Dichroma
    - Hernandez
    - Orbital Technologies
    - Star Shot
    - Payload Systems, Inc.
  - KSC
    - Dynamac (LSSC)
    - Boeing (CAPPS)

Baseline - Continuous Improvement Model
Characteristics

- Recent Continuous Improvements include both organizational and contract changes:
  - Transfer budget control to Office of Biological and Physical Research (OBPR) at NASA Headquarters
    - Previous budget was controlled through Code M, to ISS Payloads Office, to the Level II Research Program Offices and finally to the Level III Project Office
    - OBPR returns management of science requirements and budget into same office
    - OBPR “fences” ISS Utilization budget from Code M to apply only to OBPR research efforts in S/T/C
  - Strengthen science focus with appointment of ISS OBPR Program Scientist
  - Increase involvement of OBPR in decision making by participation in decision making Boards
    - Participate in Flight Assignment Working Group
    - Approve funding requests in excess of $1M
  - Consolidate contracts supporting OZ activities and MSFC Research Program Office (details under contract transition)
  - Implement initiatives at the Development Centers to reduce User verification requirements
  - Implement processes throughout ISS infrastructure to improve User interfaces through “Lessons Learned”

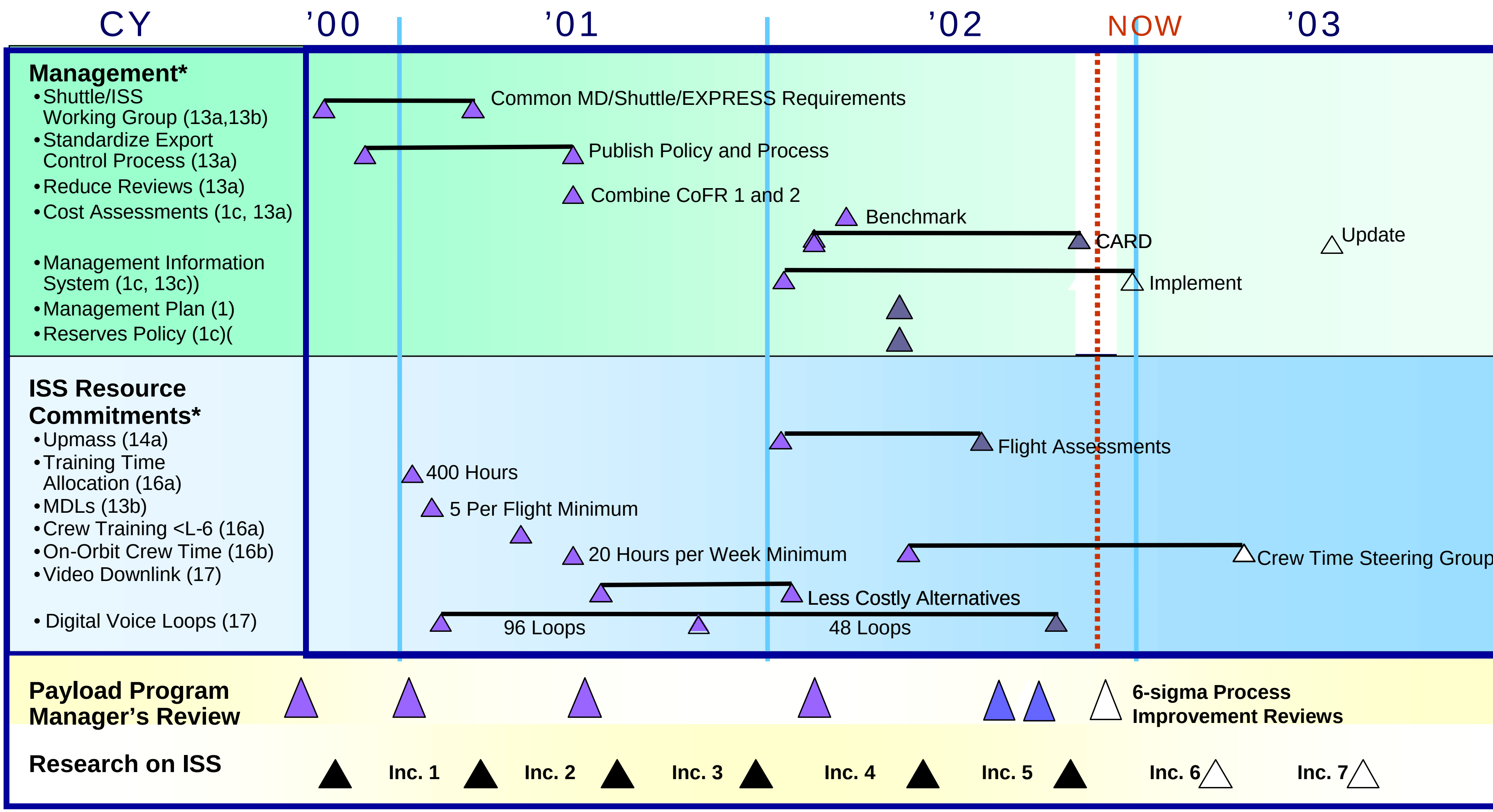
Baseline - Continuous Improvement Model
Characteristics

Continuous Improvements in Processes

- ISS Payloads Office (OZ) improvements are being integrated into the on-going ISS activities
  - Improve Management functions (see figure F)
    - Intra- and Inter-Program working groups reduce reviews and facilitate communication
    - Management Information System compiles and disseminates information
  - Improve ISS resource commitments (see figure F)
    - Upmass, middeck locker assignments, video downlink capacity
    - Crew availability (training time allocation, <L-6 training time, on-orbit crew time)
  - Improve Customer and International Partner (IP) focus (see figure G)
    - Customer Guide on CD-ROM
    - Training Team consolidation and reductions in training requirements
    - Higher quality payload simulations
    - Streamlined IP integration processes
  - Provide other integration improvements (see figure H)
    - Requirements scrubs
    - Template reductions
    - Contract consolidation

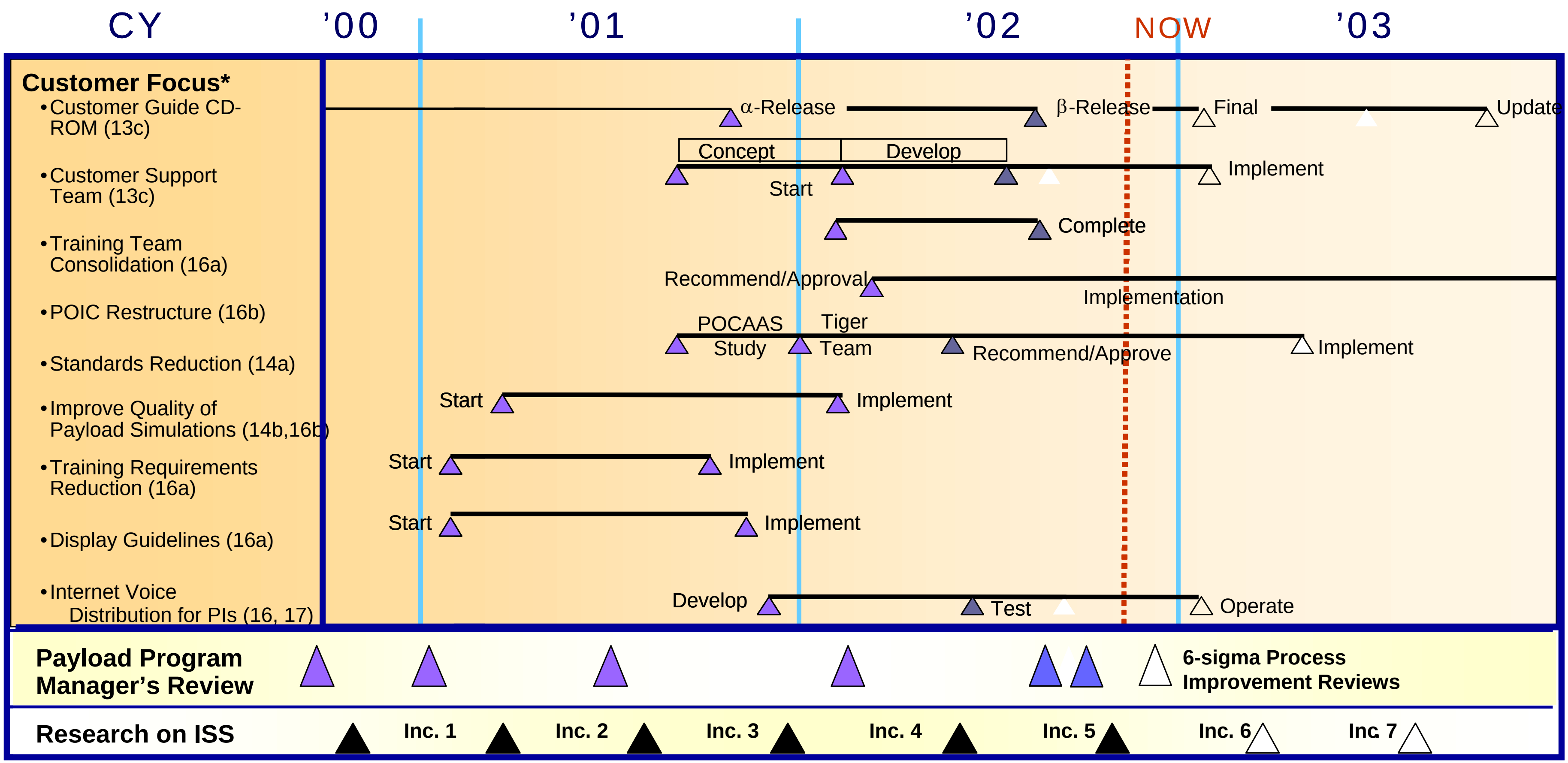
Continuous Improvement During ISS Assembly

Figure F



*Functions 6, 7 realize benefits

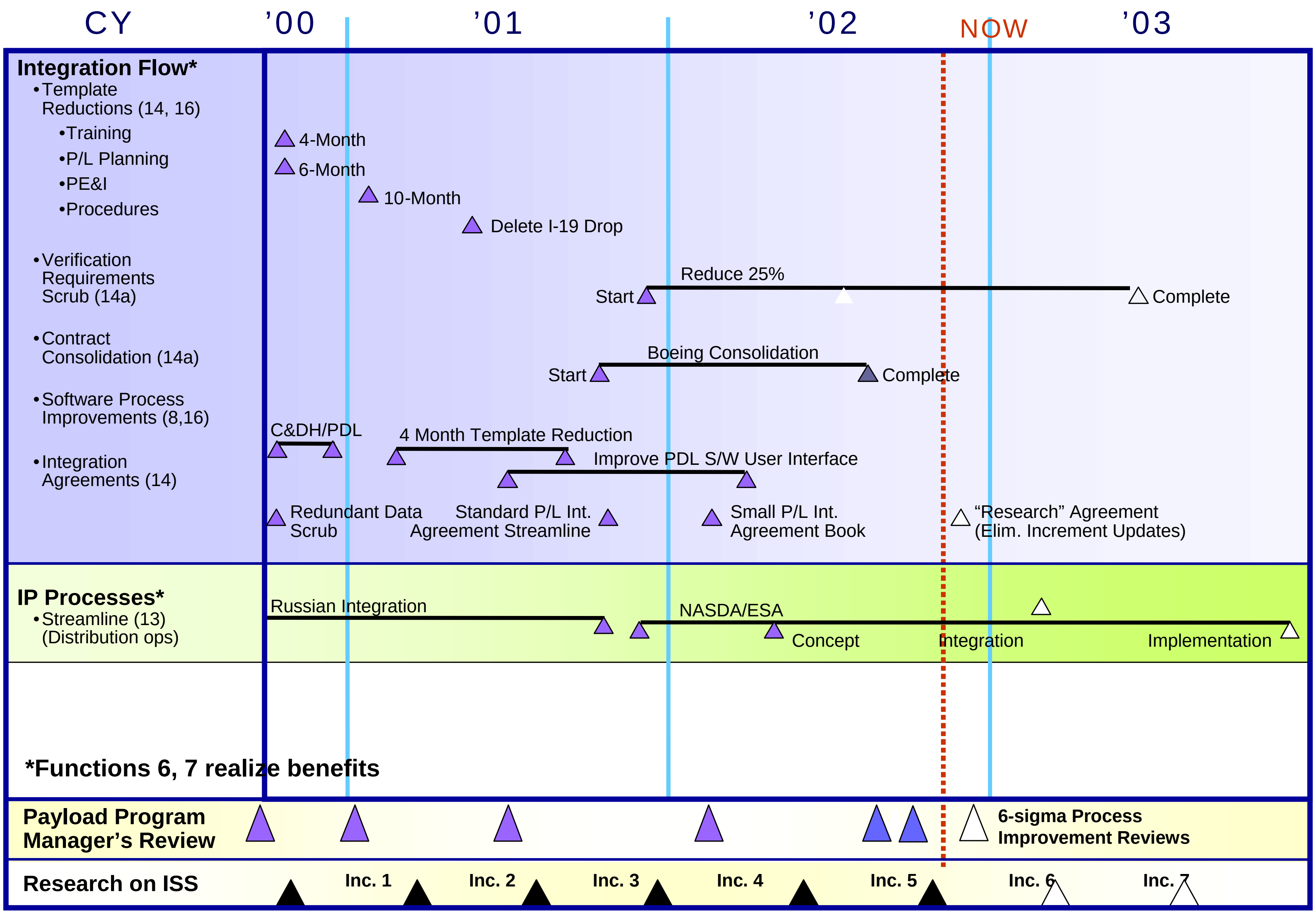
Continuous Improvement During ISS Assembly
Figure G



*Functions 6, 7 realize benefits

Continuous Improvement During ISS Assembly

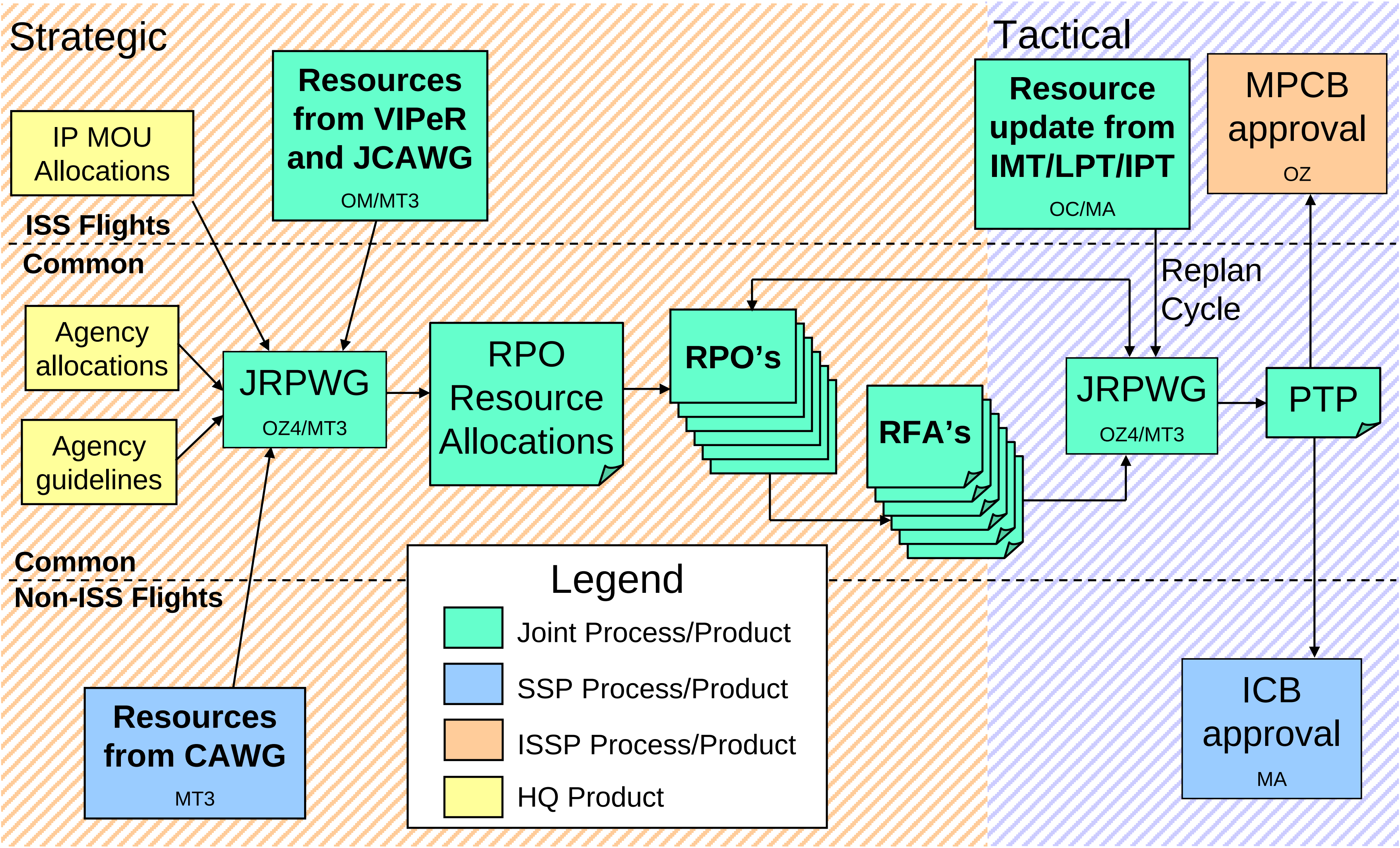
Figure H



Combined Utilization Assignment Process

- ISS Payloads Office and the Space Shuttle Customer and Integration Office are proposing a joint manifesting process to best utilize the Shuttle and Station for research
- Based on NASA Agency priorities and guidelines, a Joint Research Planning Working Group (JRPWG) will develop Payload Tactical Plans (PTP) to support STS and ISS missions (figure I)
  - Existing Shuttle and Station processes will be used to obtain resources available to Utilization
  - Common Request for Flight Assignment (RFA) forms will be submitted by the PD with top level requirements
  - International Partner MOUs provide the guidance for Partner allocations
  - The JRPWG, working with the IPs, and the Research Program Offices (RPO) from each NASA Enterprise, will develop the PTPs
  - PTPs for Station missions will be approved at the Multilateral Payloads Control Board (MPCB)
  - PTPs for Shuttle Missions will be approved at the Integration Control Board (ICB)

Combined Utilization Assignment Process
Figure I

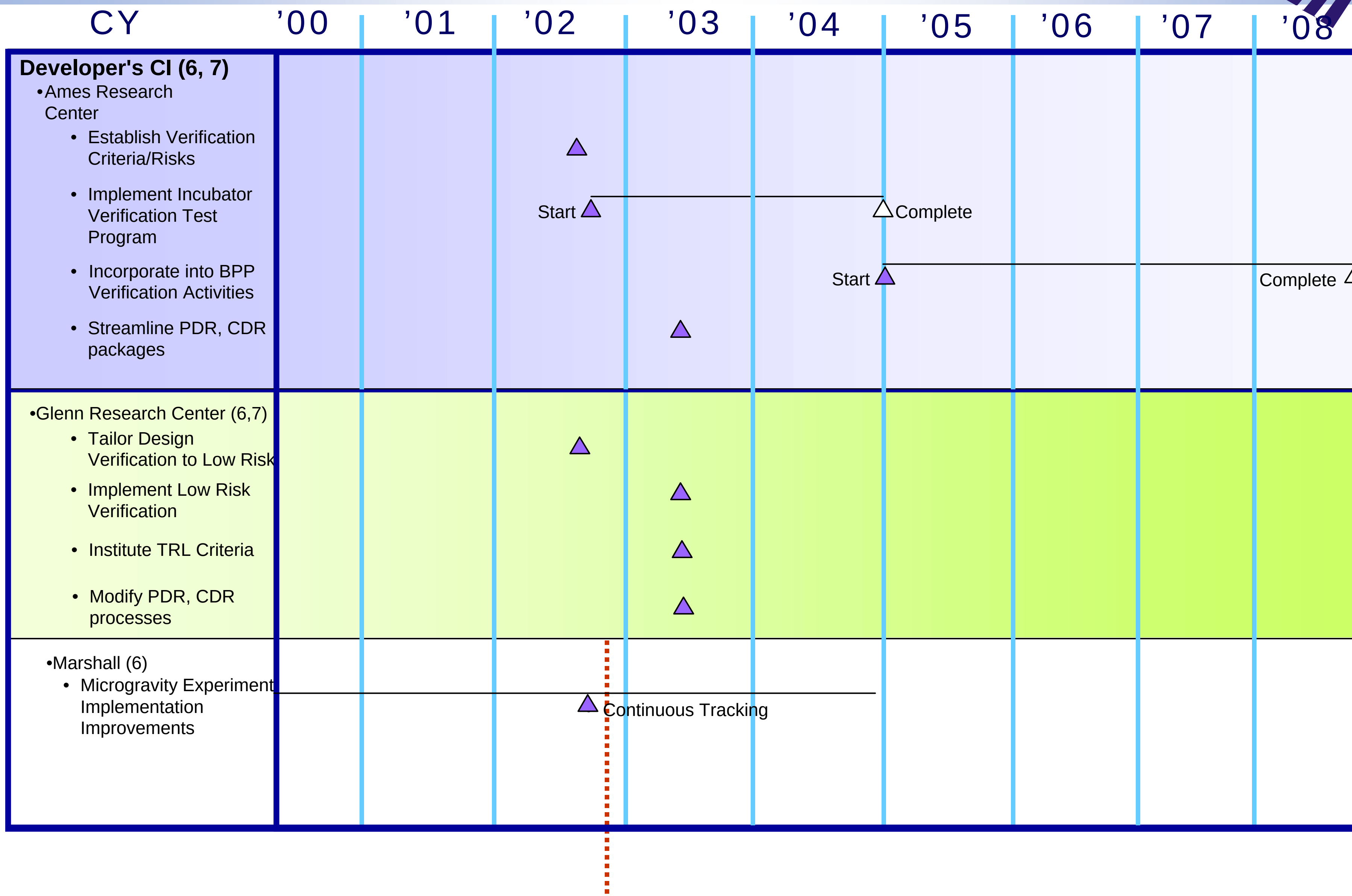


Center Continuous Improvements
(Reference Figure J)

- Hardware verification improvements
  - **Ames Research Center**
    - Low risk Verification Change Requests (VCR) will receive only cursory review
      - First application with Incubator (UF-3)
      - Anticipated verification cost reduction of 25%
  - **Glenn Research Center**
    - Tailoring design/verification review process to project risk level
- Microgravity Program Experiment Implementation
  - **Marshall Space Flight Center**
    - Time from selection to flight has been reduced
      - STS trend - 7 years
      - ISS trend - 4.5 years
    - Cost growth in hardware development has been reduced
      - STS era experienced 100% overrun
      - Data over past 5 years has not exceeded 10%
    - Contract Consolidation

Continuous Improvement During ISS Assembly

Figure J



Center Continuous Improvements
(Reference Figure J)

Other Center suggested process improvements

- **Glenn Research Center**
  - Use Institute Test Readiness Level as criteria to approve projects at Readiness Design Reviews
  - Make Science Requirements Document part of proposals in response to flight NRAs
  - Replace Science Concept Reviews and Preliminary Design Reviews with detailed plans
- **Ames Research Center**
  - Streamline packages for PRR, PDR, CDR to reduce formal review session from 8 hr to 4 hr

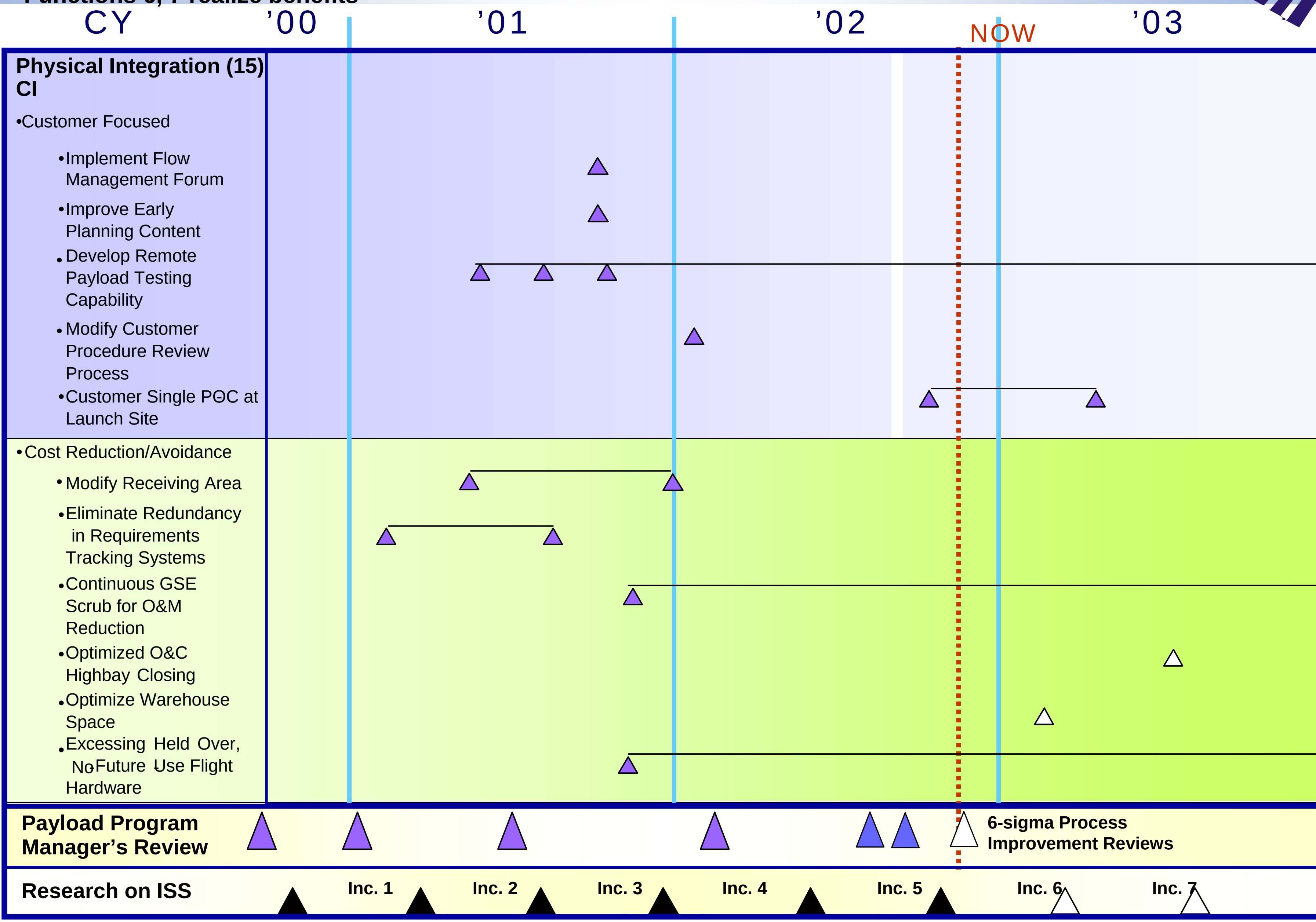
Physical Integration Continuous Improvement
(Reference Figure K)

- KSC Customer Focused Initiatives
  - Implement Flow Management Forums.
  - Convey information to customers in early planning meetings.
  - Implement Remote Payload Testing of EXPRESS racks.
  - Modify Customer Procedure review.
  - Establish single customer point of contact at the launch site.
- KSC Cost Reduction/Avoidance Initiatives
  - Modify receiving area to reduce cycle time.
  - Implement single tool requirements tracking (Operational & Maintenance Requirement System).
  - Reduce O&M and warehouse storage requirements.
  - Partner with State of Florida new bio-sciences support facility

Continuous Improvement During ISS Assembly

Figure K

*Functions 6, 7 realize benefits



Baseline - Continuous Improvement Model
Legal Structure

NASA was established through the National Aeronautics and Space Act of 1958 as a civilian Federal Agency. As such, Congress has declared that NASA's activities shall contribute to:

- Expansion of human knowledge of the Earth and phenomena in space
- Establishment of long-range studies of potential benefits gained from …space activities for peaceful and scientific purposes
- Preservation of role of US as leader in space science and technology
- Cooperation by US with other nations in work done pursuant to this Act and peaceful application
- Most effective utilization of scientific and engineering resources

The International Space Station is one Program within NASA. Central authority for "utilization management" is in the Office of Biological and Physical Research and participating Centers are authorized to perform specific functions

Baseline - Continuous Improvement Model

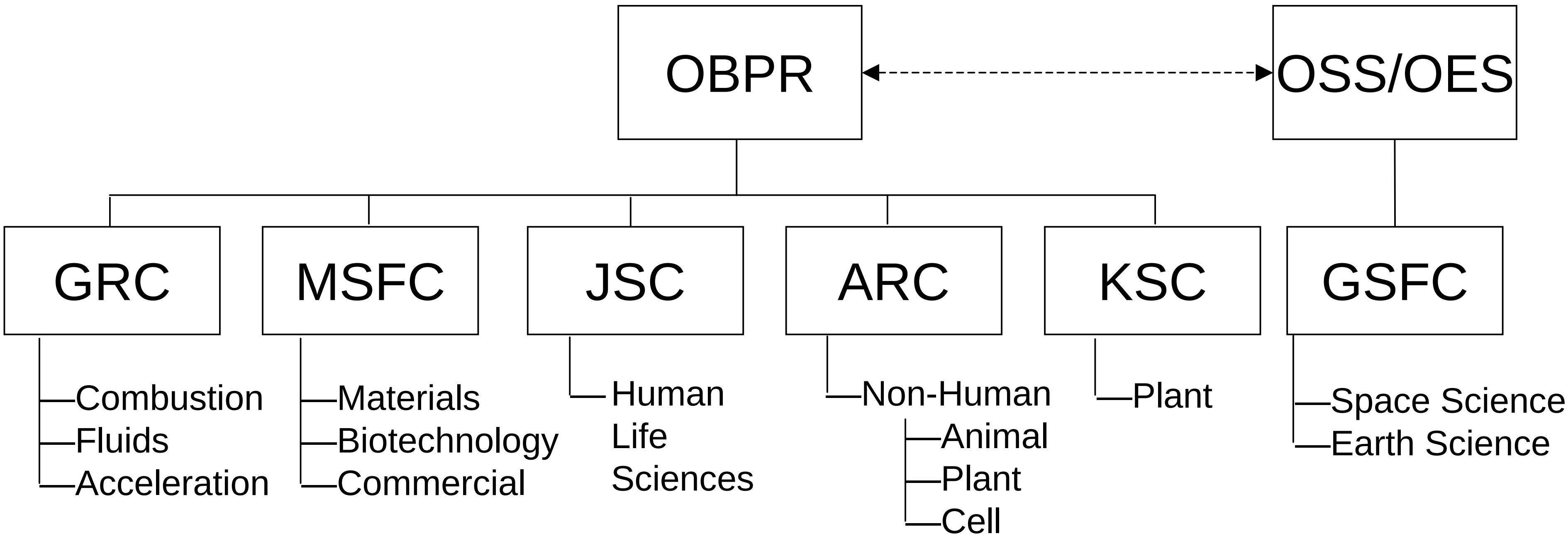
Legal Structure

- NASA elements as a Federal Agency include:
  - Administrator reports programmed activities and accomplishments to Congress in May each year.
    - Reports may include recommendations for additional legislation.
  - Research activities are subject to recommendations of NASA Advisory Council.
  - Activities are subject to security requirements, restrictions, and safeguards as deemed necessary by the Administration.
  - Personnel are subject to prosecution if found in violation of regulations of NASA in protection or security of any laboratory, station, base deemed as NASA/government property.

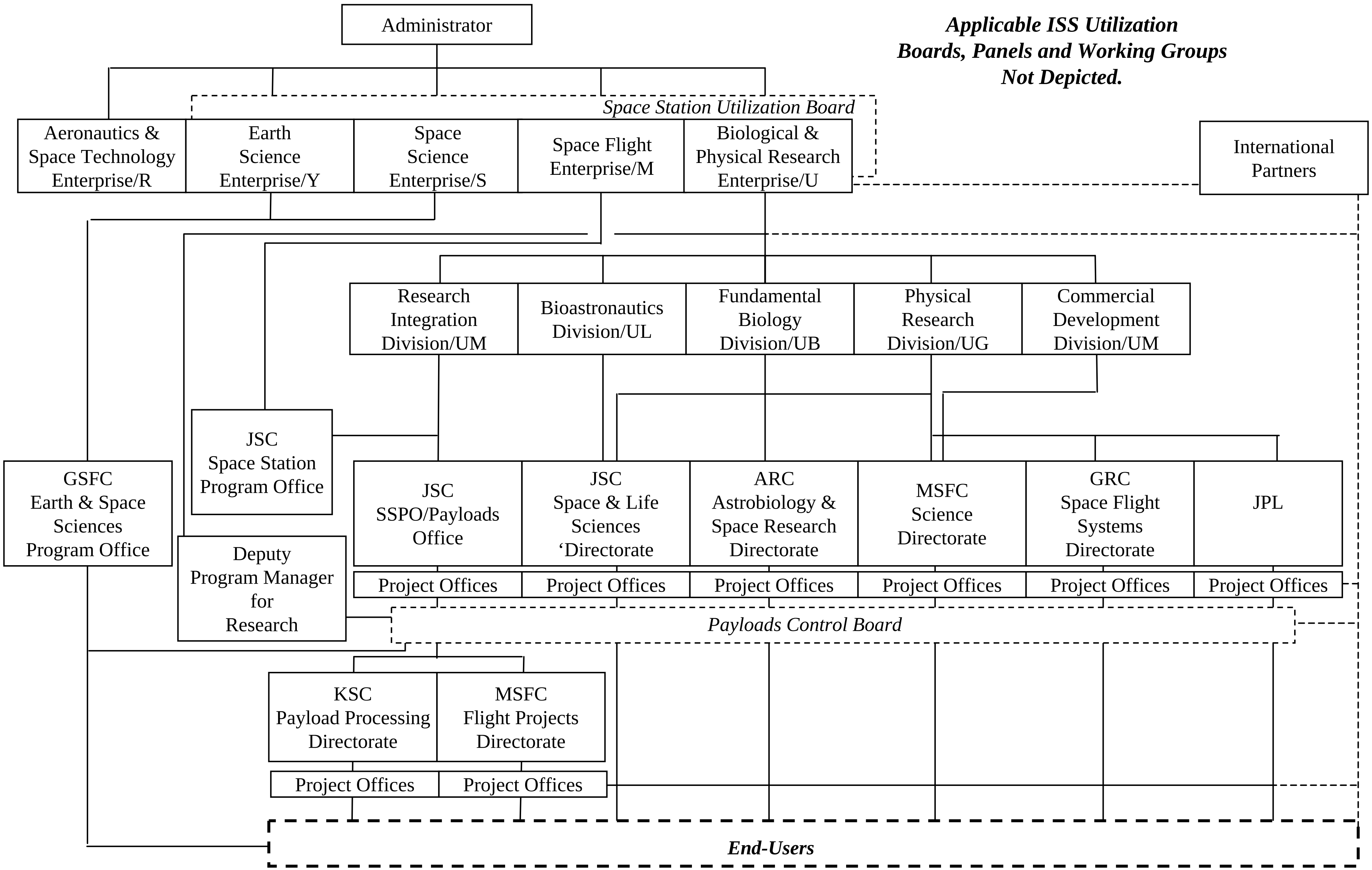
Baseline-Continuous Improvement Model
Management Structure and Interfaces

- Policy, strategic planning, and financial responsibility are within the Office of Biological and Physical Research (OBPR) at HQ
  - Space Station Utilization Board (SSUB) is at HQ and includes representation from all Codes: U, S, Y, M
  - Program Offices interface to HQ for funding and science
    - Science disciplines associate with the various Centers as shown figure L
    - Integrated organization is depicted in figure M
- Utilization Mission Management of ISS is within the ISS Payloads Office (OZ) at JSC
  - OZ interfaces to STS
  - Development Centers interface with OZ for integration of payloads
  - Payload Control Board (PCB) at JSC
  - Program Offices interface with OZ for manifesting and resource allocation
- Safety is separate from OZ and HQ and maintained as separate office for both STS and ISS

Baseline-Continuous Improvement Model
Enterprises and Discipline Areas (Figure L)



Baseline-Continuous Improvement Model
Integrated Organization (Figure M)



Baseline - Continuous Improvement Model
Timeframe and Schedule

Timeframe and schedules for the Continuous Improvement model are dependent on individual improvements and their schedule. Budgets proposed in the FY03 POP submit incorporated proposed reductions resulting from:

- Contract consolidation at JSC (OZ) and MSFC
- Hardware verification simplification at ARC and Glenn
- KSC Integration CI activities

Baseline-Continuous Improvement Model

Budget and Finance

The budget for ISS Utilization Management is part of the Program Operating Plan (POP) submitted yearly by the OBPR as part of the NASA budget presented to Congress. The budget is based on:

- Submits from the Program Offices representing payload development
- Submits by the ISS Research Mission Management represented in functions 13, 14 along with Physical Integration @ KSC and Integrated Payload Operations @ MSFC
- Submits for OBPR User Community research budgets are separate from the Utilization Budget, but are submitted by the respective Program Offices (e.g., Fundamental Space Biology, Biological Research and Countermeasures, Microgravity Research)

Current total budget for ISS Utilization (exclusive of research budgets) within OBPR is as follows*:

Fiscal Year	FY03	FY04	FY05	FY06	FY07
$M	340.7	336.1	325.8	289.0	282.8

* Data not finalized as of Aug 6

Baseline-Continuous Improvement Model

ISS Research Capability Budget

(Figure N)

			FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
			Total	Total	Total	Total	Total
			$	$	$	$	$
Content: Total ISSRC							
0	Defining and Implementing Policy and Strategic Plans		0.090	0.140	0.150	0.140	0.150
1	Management of Research Utilization		3.713	3.811	3.850	3.887	3.898
	a	Implement Strategic Plans	0.556	0.566	0.570	0.568	0.569
	b	Manage Research Programs	1.082	1.121	1.150	1.172	1.192
	c	Manage Integrated Research Utilization	2.075	2.123	2.129	2.146	2.136
2	Preparing and Allocating Budgets		1.770	1.817	1.870	1.604	1.894
	a	Budget Formulation, Justifications	1.095	1.145	0.640	0.651	1.224
	b	Budget Execution	0.676	0.673	1.230	0.953	0.669
3	Selecting and Prioritizing Research		0.113	0.126	0.134	0.141	0.150
	a	Managing selection process	0.113	0.126	0.134	0.141	0.150
	b	Selection	0.000	0.000	0.000	0.000	0.000
	c	Prioritizing selections	0.000	0.000	0.000	0.000	0.000
4	Establishing Payload/Experiment Requirements & Feasibility		17.001	17.519	18.791	16.223	16.045
	a	Research Requirements	6.195	6.134	7.746	5.780	6.687
	b	Engineering Concepts, Development, & Hardware Assessments	10.806	11.385	11.045	10.442	9.359
5	Developing Cost, Schedule, and Risk Assessments		5.465	6.020	5.850	5.816	6.657
	a	Perform Cost, Schedule, Risk Management Assessment	5.435	5.868	5.700	5.632	6.478
	b	Authority to Proceed	0.030	0.030	0.030	0.060	0.060
6	Developing and Qualifying Flight Research Systems		123.770	89.360	69.098	40.936	34.665
	a	DDT&E	79.772	54.749	31.862	22.752	17.243
	b	Subrack Integration	9.173	8.865	7.439	7.002	6.300
	c	Operations	29.924	25.746	23.468	9.005	8.837
7	Maintaining and Sustaining Flight Research Systems		27.314	21.853	37.160	39.573	37.832
	a	DDT&E	11.737	17.087	21.771	18.920	18.814
	b	Operations	2.468	4.765	8.610	12.373	12.189
8	Developing Ground Systems		7.389	7.958	9.981	7.989	7.643
9	Maintaining & Sustaining Ground Systems		26.263	27.534	28.133	8.189	8.793
	a	Identify changes/upgrades to Research Flight Systems	1.547	1.785	2.257	3.460	2.295
	b	Maintain & Sustain Research Ground Systems	2.443	2.765	3.469	3.128	4.898
10	Constructing Ground Facilities		1.148	1.182	3.052	1.792	0.902
11	Maintaining Ground Facilities		3.304	3.757	4.330	23.854	25.364
12	Certifying Safety of Research Flight & Ground Systems		8.131	8.794	9.294	7.678	7.054
13	Managing Missions and Allocating Services		13.652	13.865	14.259	14.428	14.354
	a	Advocacy, Manifesting & Resource Allocations	4.964	5.214	5.364	5.305	4.340
	b	ISS Research Mission Management	8.688	8.529	8.754	8.978	9.876
14	Integrating User Missions - Analytical		38.885	62.227	43.179	39.983	35.167
	a	Payload Engineering Integration	9.691	10.867	10.330	9.260	9.162
	b	Payload Software Integration & Flight Production	3.074	3.240	3.242	2.611	2.639
15	Integrating User Missions - Physical		17.638	20.262	22.356	21.127	22.162
16	Integrating User Missions - Operational		36.339	39.825	42.982	43.263	45.481
	a	Payload Training	6.657	7.761	8.606	8.115	7.631
	b	Operations Integration	4.371	4.723	6.908	7.318	9.010
17	Conducting Research & Analysis & Disseminating Results		3.467	3.890	4.166	5.662	6.908
18	Educating & Reaching Out to the Public (including industry)		2.697	3.227	3.644	3.205	3.941
	a	Management & Control	1.135	1.298	0.322	0.318	1.469
	b	Disseminate, Communicate & Support results to ISS customers	1.544	1.909	3.302	2.866	2.452
19	Recommending ISS Pre-Planned Product Improvements		0.512	0.622	0.752	0.747	0.798
20	Managing Archival of Research Samples, Data, and Results		2.061	2.320	2.731	2.749	2.955
		Budget Subtotal:	**340.724**	**336.110**	**325.764**	**288.983**	**282.813**

Baseline-Continuous Improvement Model

Budget and Finance

Research budgets for Codes S, Y, and M are independent of the OBPR budget

Baseline-Continuous Improvement Model
Personnel and Staffing

- The workforce under the Baseline-Continuous Improvement Model includes both civil servants and support contractors and represents Code U Enterprise.
- Personnel numbers decrease over the 4 years due to activities and experience. It is assumed with **Continuous Improvement**, these numbers **may decrease** even more in the FY06 timeframe and beyond. Workforce, as reflected in the FY03 POP submits, are as follows:

	FY03	FY04	FY05	FY06	FY07
Civil Servants	626	608	589	569	557
Contractors	1780	1764	1634	1532	1467
Total	2406	2372	2223	2101	2024

- Personnel distribution and civil service core competencies for this workforce allocated to the 21 functions are shown in figures O and P. The figures Q-1 through Q-4 show the distribution of both contractors and civil servants across the 21 functions.

Baseline-Continuous Improvement Model

Civil Service Distribution Across the 21 Functions

Figure O

Functions	FY 03 Total CS FTE	FY 03 Total Cont WY	FY 04 Total CS FTE	FY 04 Total Cont WY	FY 05 Total CS FTE	FY 05 Total Cont WY	FY 06 Total CS FTE	FY 06 Total Cont WY	FY 07 Total CS FTE	FY 07 Total Cont WY
0 **Defining and Implementing Policy and Strategic Plans**	6	0	7	0	7	0	7	0	7	0
1 **Management of Research Utilization**	17	25	17	25	17	25	17	25	17	25
a Implement Strategic Plans										
b Manage Research Programs										
c Manage Integrated Research Utilization										
2 **Preparing and Allocating Budgets**	18	7	19	7	19	7	19	7	19	7
a Budget Formulation, Justifications										
b Budget Execution										
3 **Selecting and Prioritizing Research**	3	0	3	0	3	0	3	0	3	0
a Managing selection process										
b Selection										
c Prioritizing selections										
4 **Establishing Payload/Experiment Req & Feasibility**	26	71	24	68	23	67	22	66	17	66
a Research Requirements										
b Engineering Concepts, Development, & Hardware Assessments										
5 **Developing Cost, Schedule, and Risk Assessments**	26	17	26	17	28	17	30	18	31	20
a Perform Cost, Schedule, Risk Management Assessment										
b Authority to Proceed										
6 **Developing and Qualifying Flight Research Systems**	127	510	117	427	101	291	83	206	71	184
a DDT&E										
b Subrack Integration										
c Operations										
7 **Maintaining and Sustaining Flight Research Systems**	25	107	25	142	31	148	33	161	32	157
a DDT&E										
b Operations										
8 **Developing Ground Systems**	19	35	22	42	19	42	20	35	20	31
9 **Maintaining & Sustaining Ground Systems**	70	192	55	188	49	176	42	170	42	169
a Identify changes/upgrades to Research Flight Systems										
b Maintain & Sustain Research Ground Systems										
10 **Constructing Ground Facilities**	1	7	1	7	1	11	1	9	1	7
11 **Maintaining Ground Facilities**	5	36	6	40	6	37	6	36	6	37
12 **Certifying Safety of Research Flight & Ground Systems**	16	30	17	32	17	34	17	32	17	31
13 **Managing Missions and Allocating Services**	33	83	33	79	30	79	28	79	29	77
a Advocacy, Manifesting & Resource Allocations										
b ISS Research Mission Management										
14 **Integrating User Missions - Analytical**	46	238	46	247	46	240	46	226	46	192
a Payload Engineering Integration										
b Payload Software Integration & Flight Production										
15 **Integrating User Missions - Physical**	76	120	83	134	87	144	91	135	88	132
16 **Integrating User Missions - Operational**	72	254	63	256	57	260	49	265	52	269
a Payload Training										
b Operations Integration										
17 **Conducting Research & Analysis & Disseminating Results**	20	11	24	11	27	11	31	16	31	17
18 **Educating & Reaching Out to the Public (including industry)**	11	15	12	17	12	17	12	18	14	18
a Management & Control										
b Disseminate, Communicate & Support results to ISS customers										
19 **Recommending ISS Pre-Planned Product Improvements**	2	4	2	4	2	4	2	5	2	5
20 **Managing Archival of Research Samples, Data, and Results**	5	19	5	21	7	22	8	24	9	24
TOTAL	626	1780	608	1764	589	1634	569	1532	557	1467
Total Workforce	2405		2372		2223		2100		2023	

Baseline-Continuous Improvement Model

Civil Service Competencies Across the 21 Functions

Figure P

Functions	Civil Service Competency Priority								
	ARC	GRC	JSC	KSC	LaRC	MSFC	HQ*		JPL
0 **Defining and Implementing Policy and Strategic Plans**		High	Medium						
1 **Management of Research Utilization**									
a Implement Strategic Plans	High	High	High			Medium			
b Manage Research Programs	High	High	High			High			
c Manage Integrated Research Utilization	High	Low	High			High			
2 **Preparing and Allocating Budgets**									
a Budget Formulation, Justifications	High	High			High	High			High
b Budget Execution	High	High			High	High			High
3 **Selecting and Prioritizing Research**									
a Managing selection process		Medium	High			Low			
b Selection		Low	High			Low			
c Prioritizing selections	High	Medium	High			Medium			
4 **Establishing Payload/Experiment Req & Feasibility**									
a Research Requirements	High	High	High			High			High
b Engineering Concepts, Development, & Hardware Assessments	High	High	High			High			High
5 **Developing Cost, Schedule, and Risk Assessments**									
a Perform Cost, Schedule, Risk Management Assessment	High	High	High			High			High
b Authority to Proceed		Medium	High			Medium			Low
6 **Developing and Qualifying Flight Research Systems**									
a DDT&E	High	High	High	High	High	High			High
b Subrack Integration	High	High	High	High	High	High			Low
c Operations	High	High	High	High		High			Medium
7 **Maintaining and Sustaining Flight Research Systems**									
a DDT&E	High	Medium	High			High			Medium
b Operations	High	Medium	High			High			Low
8 **Developing Ground Systems**	High	High	High			High			High
9 **Maintaining & Sustaining Ground Systems**									
a Identify changes/upgrades to Research Flight Systems	Medium	Medium	Medium			High			Medium
b Maintain & Sustain Research Ground Systems	Medium	Low	Medium			High			Medium
10 **Constructing Ground Facilities**	Low	Low	Low						Low
11 **Maintaining Ground Facilities**	Low	Low	Low			High			Low
12 **Certifying Safety of Research Flight & Ground Systems**	High	High	High	High		High			Medium
13 **Managing Missions and Allocating Services**									
a Advocacy, Manifesting & Resource Allocations		High	High			Medium			Medium
b ISS Research Mission Management	Medium	Medium	High			Medium			Medium
14 **Integrating User Missions - Analytical**									
a Payload Engineering Integration	Medium	Medium	Medium			Medium			Medium
b Payload Software Integration & Flight Production	Medium	Medium	Medium			Medium			Medium
15 **Integrating User Missions - Physical**	Medium	Low	Low	High		High			
16 **Integrating User Missions - Operational**									
a Payload Training	Medium	Low	Low			High			
b Operations Integration	Medium	Low	Medium			High			
17 **Conducting Research & Analysis & Disseminating Results**	Low	High	High			High			High
18 **Educating & Reaching Out to the Public (including industry)**									
a Management & Control	Low	High	High			High			High
b Disseminate, Communicate & Support results to ISS customers	Low	High	High			High			Medium
19 **Recommending ISS Pre-Planned Product Improvements**	Low	Low	Low			Low			
20 **Managing Archival of Research Samples, Data, and Results**	Low	Low	High			Low			

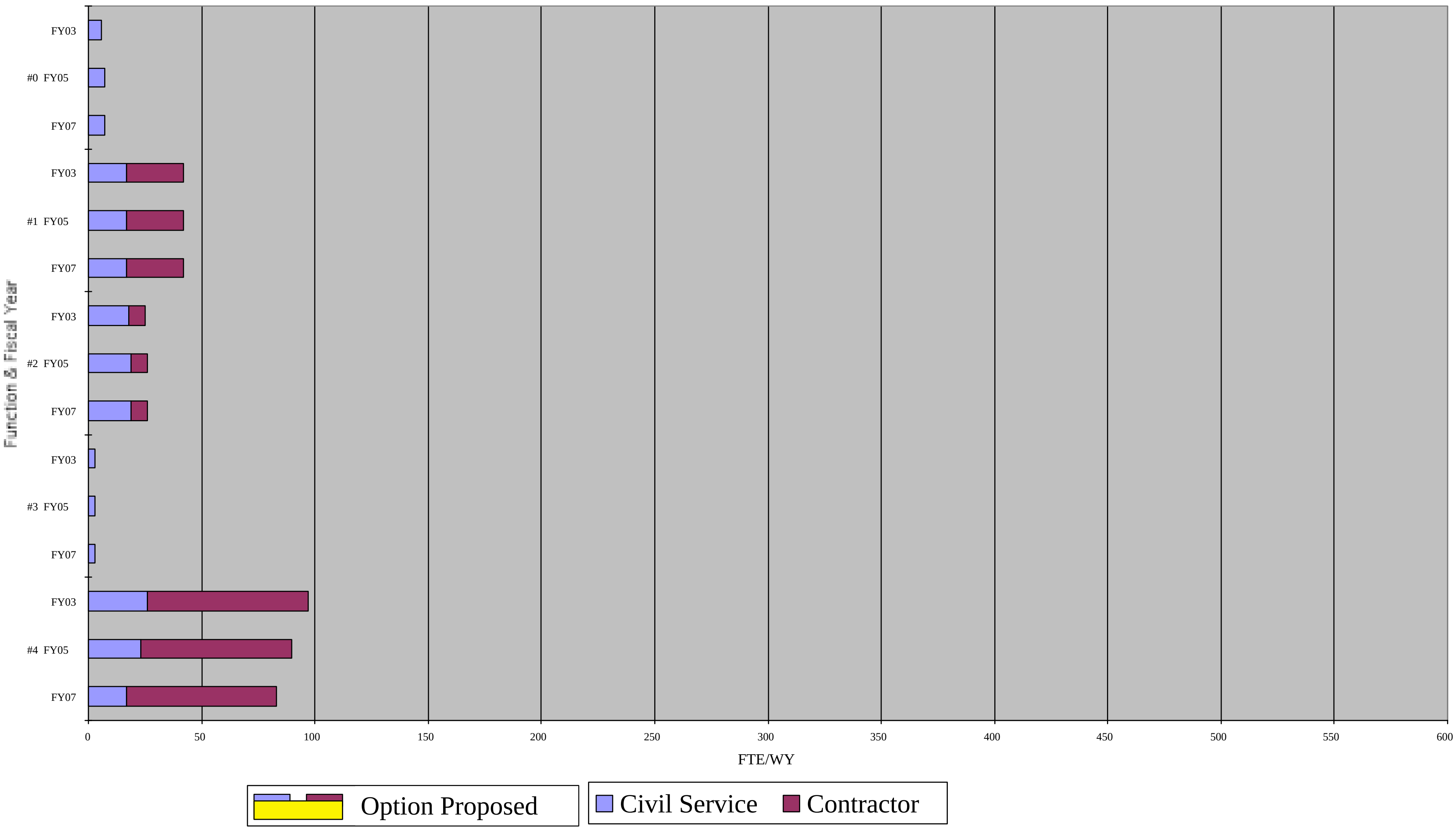
KEY	
(blue)	High Priority
(violet)	Medium Priority
(green)	Low Priority

* HQ (Code U) FTE and Competency Priorities will be identified following discussions

Baseline-Continuous Improvement Model

Workforce Implementation for Functions 0 thru 4

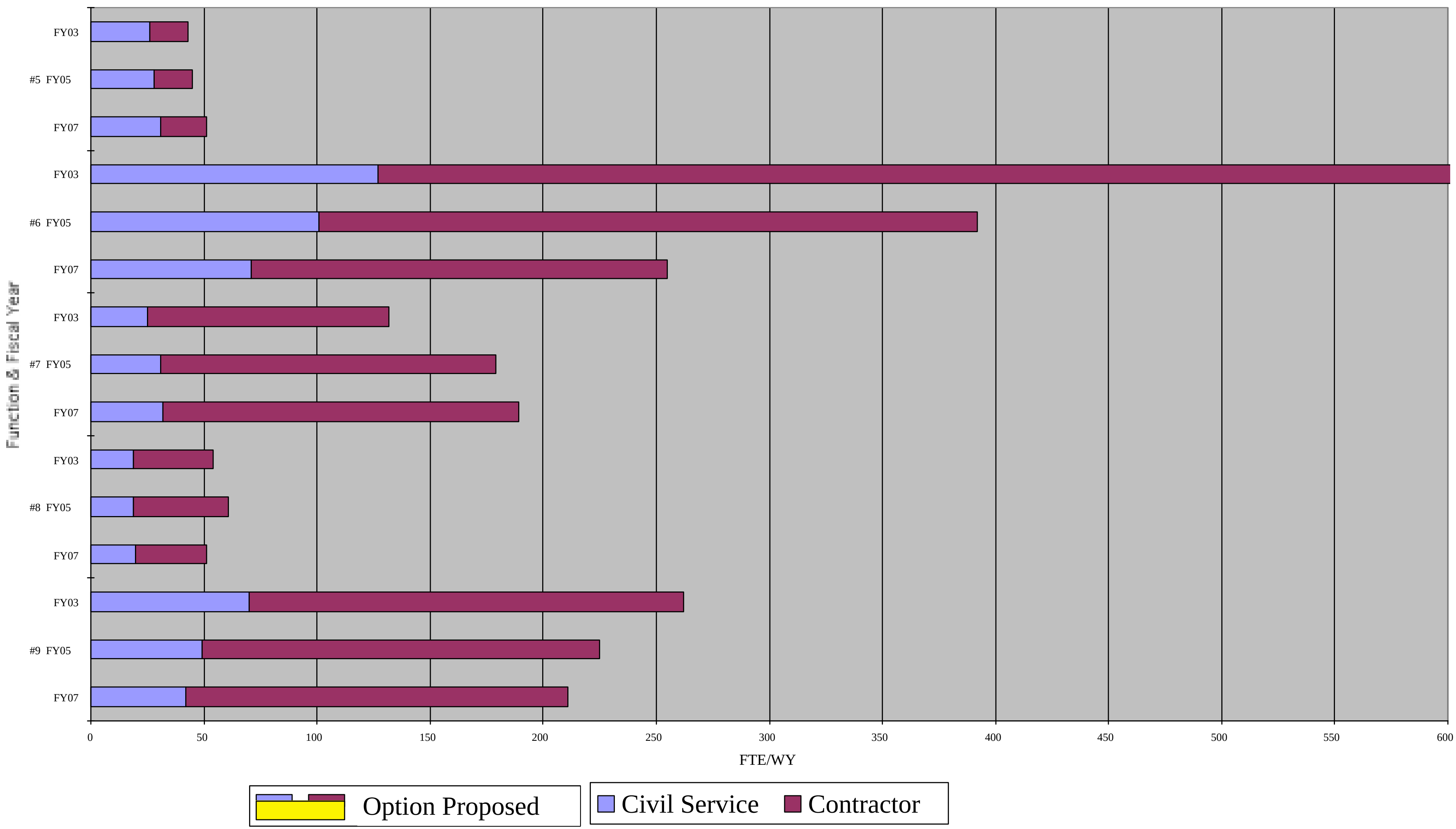
Figure Q-1



Baseline-Continuous Improvement Model

Workforce Implementation for Functions 5 thru 9

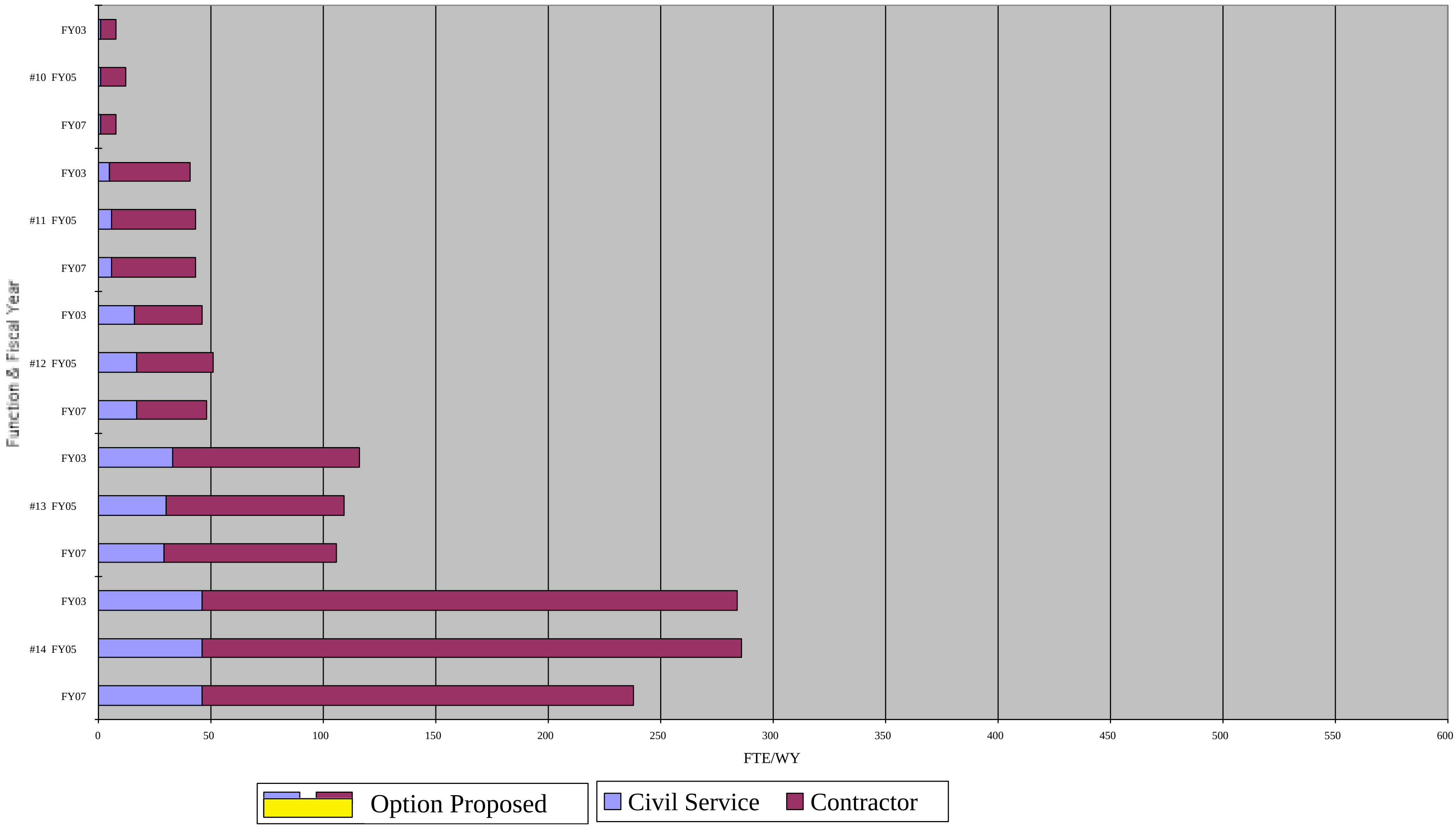
Figure Q-2



Baseline-Continuous Improvement Model

Workforce Implementation for Functions 10 thru 14

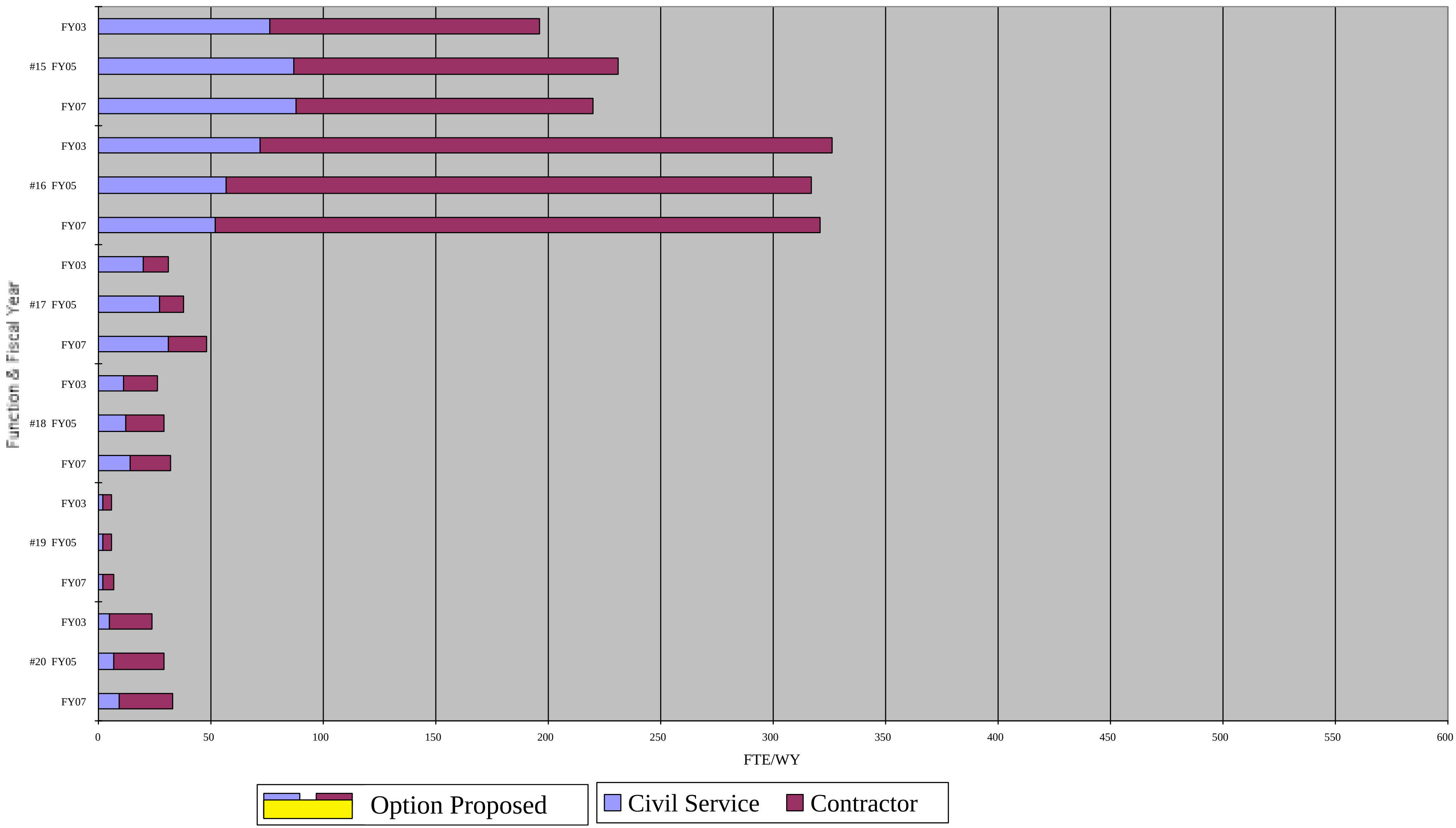
Figure Q-3



Baseline-Continuous Improvement Model

Workforce Implementation for Functions 15 thru 20

Figure Q-4



Baseline-Continuous Improvement Model

Procurement

ISS Utilization Management as part of a Government Agency is subject to Federal Acquisition Regulations and obtains support and/or interacts with outside parties through:

- Competitive contracts
  - Support service contracts to all functions at all Centers (see figure R)
  - Build of Research Facilities
- Co-operative agreements
  - Science Institutes
  - Commercial Centers
- Space Act Agreements
  - Other commercial activities
- Grants
  - Funding mechanism for researchers selected to fly on ISS
  - Contracts in some instances

Contract Support and Agreements

Figure R

- **OBPR**
  - Global Science Technologies
  - **GRC**
    - ZIN Technologies
    - Northrup Grumman
    - NCMRFC (Coop Agreement)
  - **MSFC**
    - Boeing
    - Lockheed-Martin
    - Cherokee Nations
    - Teledyne Brown
    - Hernandez
    - Pace and Waite
    - ASRI
    - CST
    - CSC
    - Infinity Tech. Inc.
    - Boeing
    - AMMSA
    - CortezTechMasters
    - Sverdrup
    - TBS
    - Bd Systems
  - **OZ**
    - USA
    - Boeing
    - Lockheed-Martin
    - SAIC
  - **JSC**
    - Lockheed-Martin
    - NSBRI (Coop Agreement)
    - Wyle Laboratories
  - **ARC**
    - Lockheed-Martin
    - Dichroma
    - Hernandez
    - Orbital Technologies
    - Star Shot
    - Payload Systems, Inc.
  - **KSC**
    - Dynamac (LSSC)
    - Boeing (CAPPS)

Baseline-Continuous Improvement Model

Performance Evaluation

- To assure appropriated funds are spent wisely, the government is responsible for performing surveillance of work performed for the Agency in a manner proportional to the risk involved with the activity (cost, schedule, and/or technical)
- Program, project, and technical offices, in conjunction with contract administration offices, are required to:
  - Develop and apply efficient procedures to assure quality assurance actions
  - Perform actions to verify whether the supplies/services conform to contract quality requirements
  - Maintain records reflecting contract administration action/results of those actions
  - Define and implement surveillance procedures
    - Overall approach NASA to monitoring performance
    - Continual monitoring and verification of status of entity
    - Government process to obtain critical information for managing resources and requirements relative to cost and fee

Baseline-Continuous Improvement Model

Performance Evaluation

- Define and implement surveillance procedures (cont'd)
  - Combination of insight, oversight, and hybrid of two
    - Insight process uses **product performance** and performance metrics to ensure:
      - Process capability,
      - Product quality, and
      - End item-effectiveness
    - Oversight uses **customer imposed product specification** and process controls, e.g.,
      - Unique requirements
      - MIL specifications
      - MIL standards
      - Mandatory inspections
    - Hybrid combines elements of insight and oversight
      - Institute at contractor's facility when doubtful of contractor ability to identify, manage, and control programmatic risks

Baseline-Continuous Improvement Model

Performance Evaluation

- Define and implement surveillance procedures (cont'd)
  - Responsibility for implementation and oversight with NASA Program/Project Offices or Technical Lead
  - Functional support offices with collaborative responsibility
    - Project management
    - Safety and Health
    - Engineering
    - Procurement
    - Quality
    - Financial
    - Incorporate all offices into contract Surveillance Plan

Baseline-Continuous Improvement Model

Other Considerations

- **Alternate operational model – Reinvent NASA**
- Create funding wedge for CI as alternate to budget increases of transition experienced in all other models
- Implement suggestions from SSUAS Workshop
  - Develop ISS Users' Guide (in work by OZ - final release due Jan-03)
  - Develop Uniform Standards of Mission Success across payload categories (S/T/C) with fewer constraints on qualifying hardware
  - Provide early safety training by PSRP for payload developers
  - Consolidate safety reviews (currently center by center and joint program ops)
  - Develop uniform approach to training between disciplines to involve user and ensure PI satisfaction
  - Advertise availability of archived data (including physical and biological samples)
  - Continue to address amount of documentation required by PIs/PDs
  - Use commercial advertising agency to promote ISS Utilization
  - Improve coordination of NRA release w/ISS (maturity, partners, etc.)

Baseline-Continuous Improvement Model

Other Considerations

- Make process transparent to user
  - ISS integration philosophy is centered around distributed approach where rack integration is the responsibility of the Facility developer
    - Facility developers have large experienced staff capable of meeting ISS requirements
    - PI interfaces to Facility Developer and is isolated from Space Station
  - Approach was applied to non-facility developers (EXPRESS Rack and deployed payloads)
    - Non-facility developers are populated with range of staff and experience and struggle with complex integration processes
    - ISS does not provide consistent support across the Program to non-facility PIs and they have not been isolated from the Process
  - Support to those subrack payloads that require it is key to making the complex process transparent to the user

Baseline-Continuous Improvement Model

Other Considerations

- Make process transparent to user (cont'd)
  - The ISS Payloads Office is taking steps to increase customer support including:
    - Incorporating incentives in consolidated Boeing contract to provide and increase customer support by creating customer satisfaction component in determination of award fee
    - Expanding customer satisfaction efforts by providing a "hot-line" and a post-flight survey to measure satisfaction
    - Updating operations integration processes to support PDs through the process (e.g., procedure and display development, training)
  - Streamlining the requirements and emphasizing customer satisfaction will be great improvement from the user perspective.

Baseline - Continuous Improvement Model

Options

Package elements 6-10 are not applicable to this model, in terms of changes.

For completeness, figures S-1 through S-6 show the facilities used throughout the Agency in support of Utilization Management. This listing is a preliminary assessment gathered by Blue Team members. Code JX (HQ) has assembled a square footage and cost assessment in cooperation with Centers' Facilities Management.

On-going contract transitions affect eventual continuous improvement model, as indicated in following charts.

Baseline-Continuous Improvement Model

Facilities Utilized

- Reference HQ/Code JX facility data

Baseline-Continuous Improvement Model

Contract Transitions

- Most contracts supporting ISS (OZ) are ending; ISS is consolidating functions supported by these contracts (see figure T)
  - Utilization support contracts will be consolidated into the Payload Mission Contract
  - ISS Payloads Office is consolidating Boeing contract support into one ISS Payload Integration Contract (IPIC)
  - Immediate cost savings are expected with the reduction of management overhead and technical duplication
  - IPIC and the remaining functions will be consolidated in an open competition into the Payload Mission Contract in the FY 05 – 06 time frame
    - Depending on the readiness of the NGO, functions will transition from the Payload Mission to the NGO
    - ISS Payloads Office contract strategy protects for the possibility of no NGO

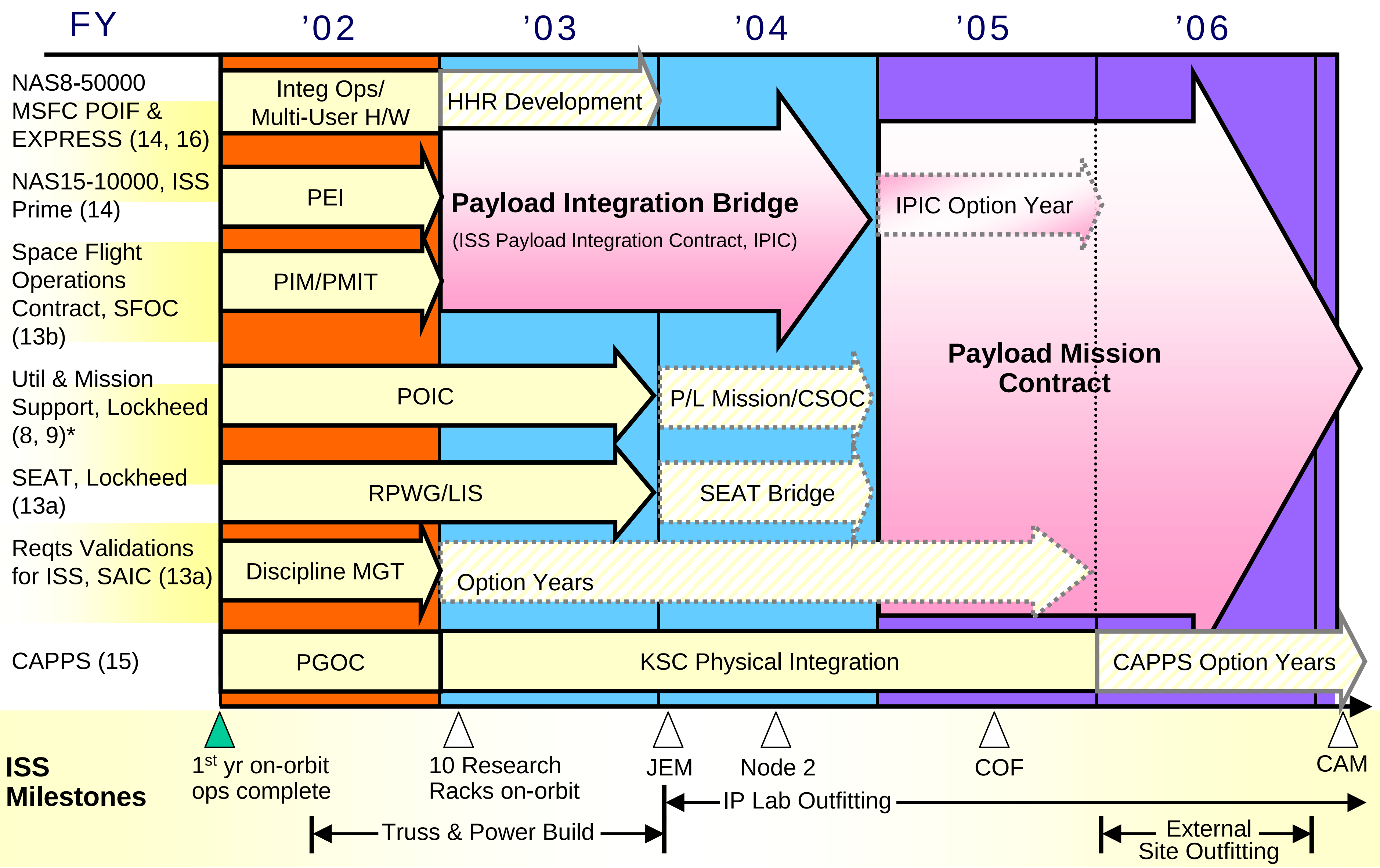
Baseline-Continuous Improvement Model

Contract Transitions

- Microgravity Research Program Office contractor task implementation and management consolidation is expected to reduce costs. (see figure U)
  - Savings since consolidation began $150K
  - Additional savings estimated $255K
  - Additional savings are expected due to lower civil servant contract management requirement

ISS Payloads Office Contract Transition Strategy

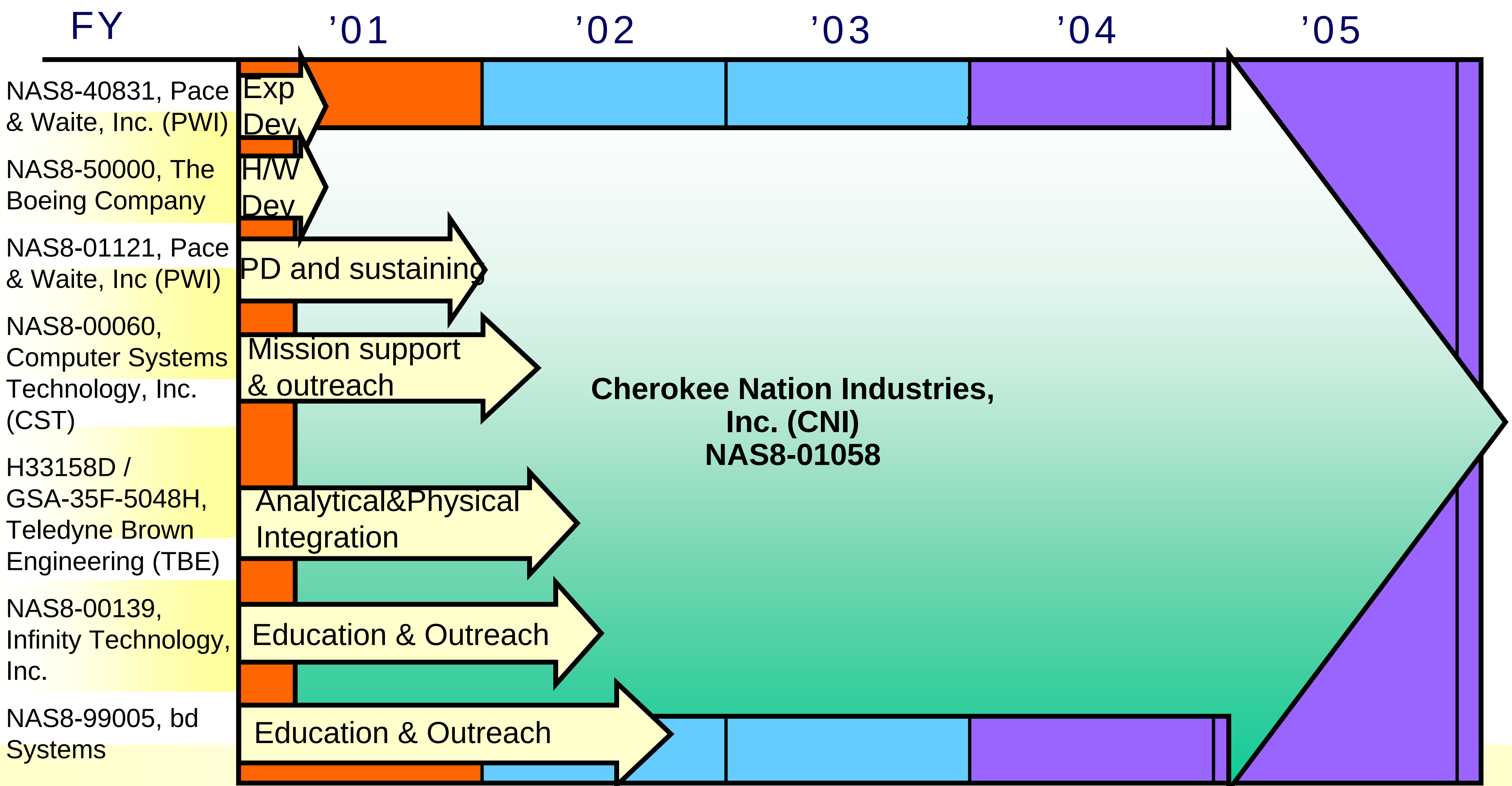
Figure T



* ISS Ground Segment only

Microgravity Research Program Office Contract Transition Strategy

Figure U



Baseline-Continuous Improvement Model

Advantages/Disadvantages/Risks/Mitigation Plans

Legal Structure

Advantages	Disadvantages	Risk	Risk Mitigation
No additional legal authority is required since authority comes from NASA's mission as defined in the Space Act	Government statues and regulations must be followed along with Congressional direction.	Congressional demand that an NGO be established along with presidential severe downsizing of civil service staff	Strive toward CI and remedy those issues raised by user community. Nothing can be done about CS downsizing.
Well-defined set of policies and directives currently exist	Cannot lobby	That value of CI are never recognized	Continue customer feedback and surveys with follow-up on improvements implemented or not implemented.
Can perform Inherently Governmental functions	Must also take full blame for any errors in inherently governmental functions	Loss of public confidence in NASA's capabilities	Maintain experienced, trained, and sufficient workforce to properly track all elements
Can hold property and loan property to other organizations	Formal constraints on loan agreements and associated administration	Bureaucracy may outweigh any advantages realized in property loans, especially in conduct of international research	Continuous attention to and projection of needs to assure timely implementation
Permits reimbursement via Space Act Agreements	Perceived bureaucracy in paperwork involved.	Commercial, industry, and technology transfer discouraged	Ensure knowledgeable Team members with experience who can readily handle administrivia and project future requirements
Ability to make agreements with other governments			

Characteristics

Advantages	Disadvantages	Risk	Risk Mitigation
Direct International coordination and ability to invest authority in IP's, e.g., final verification approval.	Organization with multiple interfaces which adds complexity to integration process		
Government leadership emphasizes US role as leader in space science and technology	Personnel tied to operational activities for life of ISS which might be applied to other "tech breaking"		

Baseline-Continuous Improvement Model

Advantages/Disadvantages/Risks/Mitigation Plans

Characteristics (continued)

Advantages	Disadvantages	Risk	Risk Mitigation
Activities subject to NAC	NASA does not always follow NAC recommendations	Alienation of science community	Strengthen interfaces with science community and bring accomplished and recognized scientists into leadership roles within NASA
Provides Program Chief Scientist who can focus research pursuits and make research thrust visible to the science community	Cumbersome interfaces, e.g., to Mission Management structure, to International Science Groups (e.g., ISSLSWG)	Chief Scientist interfaces with HQ science management instead of science community.	Establish IWG's for each increment similar to that of SpaceHab and historic SpaceLab
Ability to implement cost reduction in hardware verification activities through CI	No "unified" effort across development Centers to ensure standardization of processes and	Everyone not aware of issues in development and verification from Center t resulting in continuing	Make communication a top priority throughout ISS Utilization, e.g., One NASA
Managed by civil service with contractor support	Perception that engineering is total focus of ISS since NASA viewed as engineering organization	Continue to be perceived as an engineering organization	Program scientists advertise as a science organization through increased outreach efforts
Ability to combine contracts	Fewer checks and balances with few contracts	Perceived as an Engineering Organization managed by Boeing	Ensure proper balance in science representation and communication throughout program
Transfer of funding control to OBPR and involvement of OBPR, S, Y in SSUB	Too many functions/ power at HQ without adequate knowledge of all processes for Utilization Management	Funds are applied to other programs, e.g., Free Flyer	Establish a separate Enterprise for ISS Utilization Management
Corporate knowledge and experience has been established	May be viewed as not responsive to new processes which may be simpler and with fewer interfaces	That current organization becomes complacent	Leadership works toward CI with constant User interfacing and feedback
Ability to implement continuous improvement process at all levels from Mission Management to PD	Efforts lead to optimized functions, not an optimized system		
Multiple contracts allow more organizations outside of government to participate in ISS Utilization	Multiple contracts confuse interfaces for external community		

Baseline-Continuous Improvement Model
Advantages/Disadvantages/Risks/Mitigation Plans

Budget and Finance

Advantages	Disadvantages	Risk	Risk Mitigation
Does not require additional funding for implementation	Budget availability often subject to political "wind" and attached bills	Loss of "planned" funding	Like a contractor, all NASA must strive toward optimum performance to illustrate capabilities and maintain public confidence. Maintain a constant vigilance to what "public" considers broke.
	Restrictions on moving budget authority across budget line items	Inability to readily "fix" one issue with under-runs in another issue, e.g., govt. carry over issue encourages "unnecessary" spending	Ensure that ISS program maintains close monitoring of budgets throughout all elements.

Procurement

Advantages	Disadvantages	Risk	Risk Mitigation
Procedures for buying and selling goods and services are established and well known	Federal procurement and disposal regulations require procedures that are often time consuming and paperwork intensive for the Government and contractors		
Regulations emphasize competition and acquiring best value.	Limited authority for excluding potential suppliers		
Agency may terminate contracts for the Government's convenience.			

Baseline-Continuous Improvement Model

Advantages/Disadvantages/Risks/Mitigation Plans

Workforce

Advantages	Disadvantages	Risk	Risk Mitigation
Current personnel have learned from 10 years of dealing with ISS issues and bring experience	Numbers of civil servants involved reduce available manpower to new pursuits which NASA should be addressing vs. remaining an Operations organization	Aging workforce (25%) going into retirement and loss of corporate memory and experience base	Open hiring and implement mentoring program with personnel matrixed to ISS, but also venturing into other programs as more contractor support assumes responsibility
No additional EPs needed to implement CI.	New blood and new ideas will not have an opportunity to be introduced	Ability to maintain quality source of experience and knowledge	Include good incentives to contracts (which might come out as equivalent to transition costs for an NGO)

Facilities

Advantages	Disadvantages	Risk	Risk Mitigation
Retain current facilities utilization where ground support systems have been well established	All facilities involved could potentially be released for other programs. Many of the facilities may be aging requiring refurbishment investments in 5 years or less since they are already elements dating to early '60's.	Aging facilities at development centers which may eventually result in extensive overhead costs	Agency recognize the issue throughout all centers

Baseline-Continuous Improvement Model

Advantages/Disadvantages/Risks/Mitigation Plans for Workforce

Management Structure and Interfaces

Advantages	Disadvantages	Risk	Risk Mitigation
Current structure well understood by User's as we now enter Increment 5	Not all Users understand processes and feel they are lengthy and too many interfaces		
HQ OBPR (source of Science Policy) now part of many ISS Boards	Current structure does not clearly define OBPR interfaces; participation may result in dilution of total science programs (both flight and ground)	Structure interfaces for all actions may be unclear	Create a new Enterprise which focuses on Mission Management, but clearly retains Science emphasis
Multiple Centers (representing discipline authorities) interface with OZ for integration of payloads into ISS	Too many elements exhibiting own Center interests and processes vs. centralized, simplified organization		

Timeframe and Schedule

Advantages	Disadvantages	Risk	Risk Mitigation
No additional financial burden as result of need to implement transition phase seen in other models	Improvements not immediately obvious, but viewed as same old way of doing business or "doing nothing at all."	Diminishing Congressional support since viewed as "non-compliant"	Work closely with User Community to assure their satisfaction and support.

Performance Evaluation

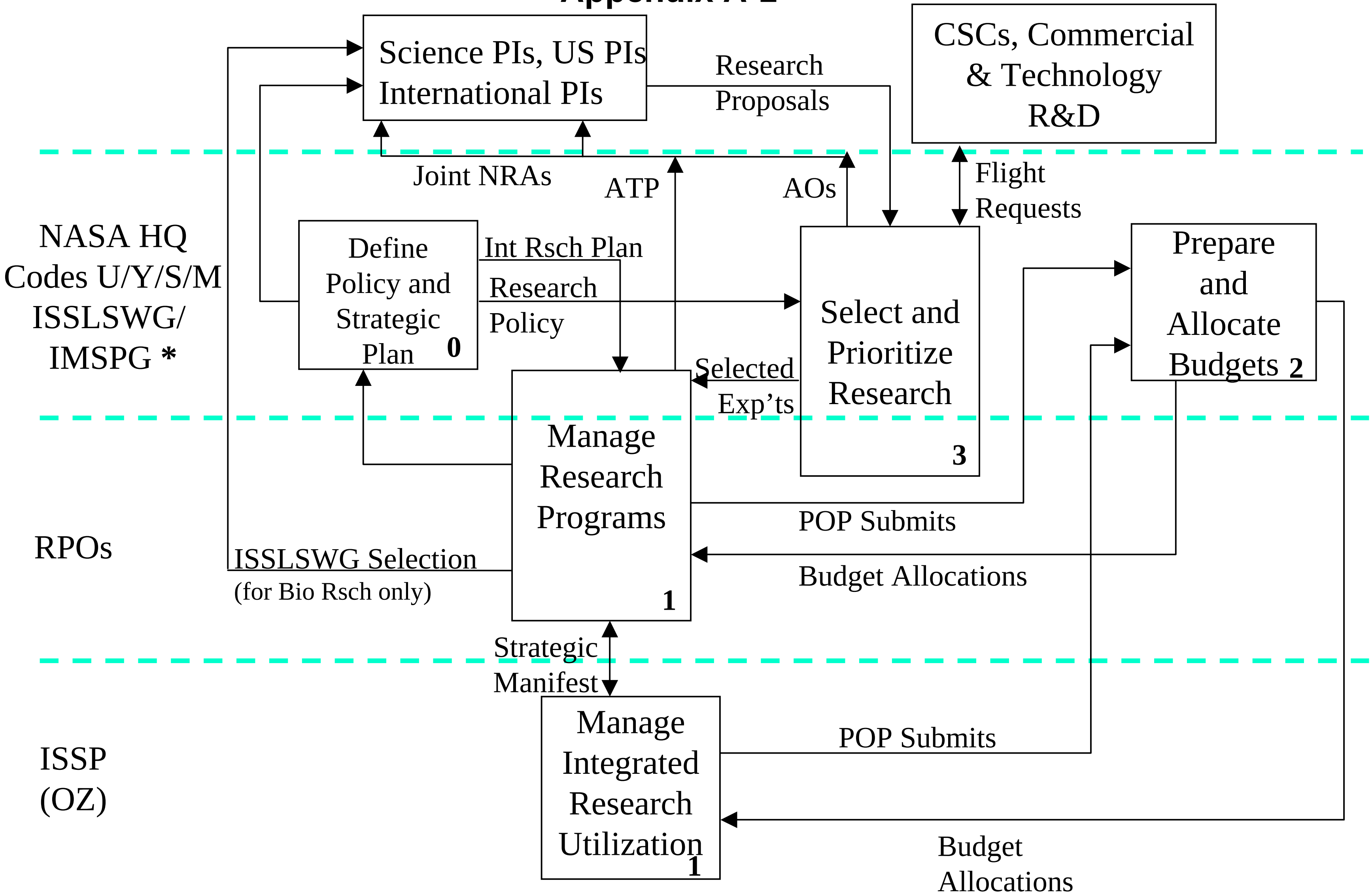
Advantages	Disadvantages	Risk	Risk Mitigation
Strict well established definition exists for evaluating contracts	Often viewed as limiting due to government regulations		

Appendix A
Detailed Transaction Flows

A-1	Selection, Formulation & Manifesting
A-2	Post Experiment Selection
A-3	Post Manifest Baseline
A-4	Non-Hardware Related Activities
A-5	Managing Missions and Allocating Services
A-6	Integrating User Missions - Analytical
A-7	Integrating User Missions - Operational

Level 1 ISS Utilization Flow
Selection, Formulation & Manifesting

Appendix A-1

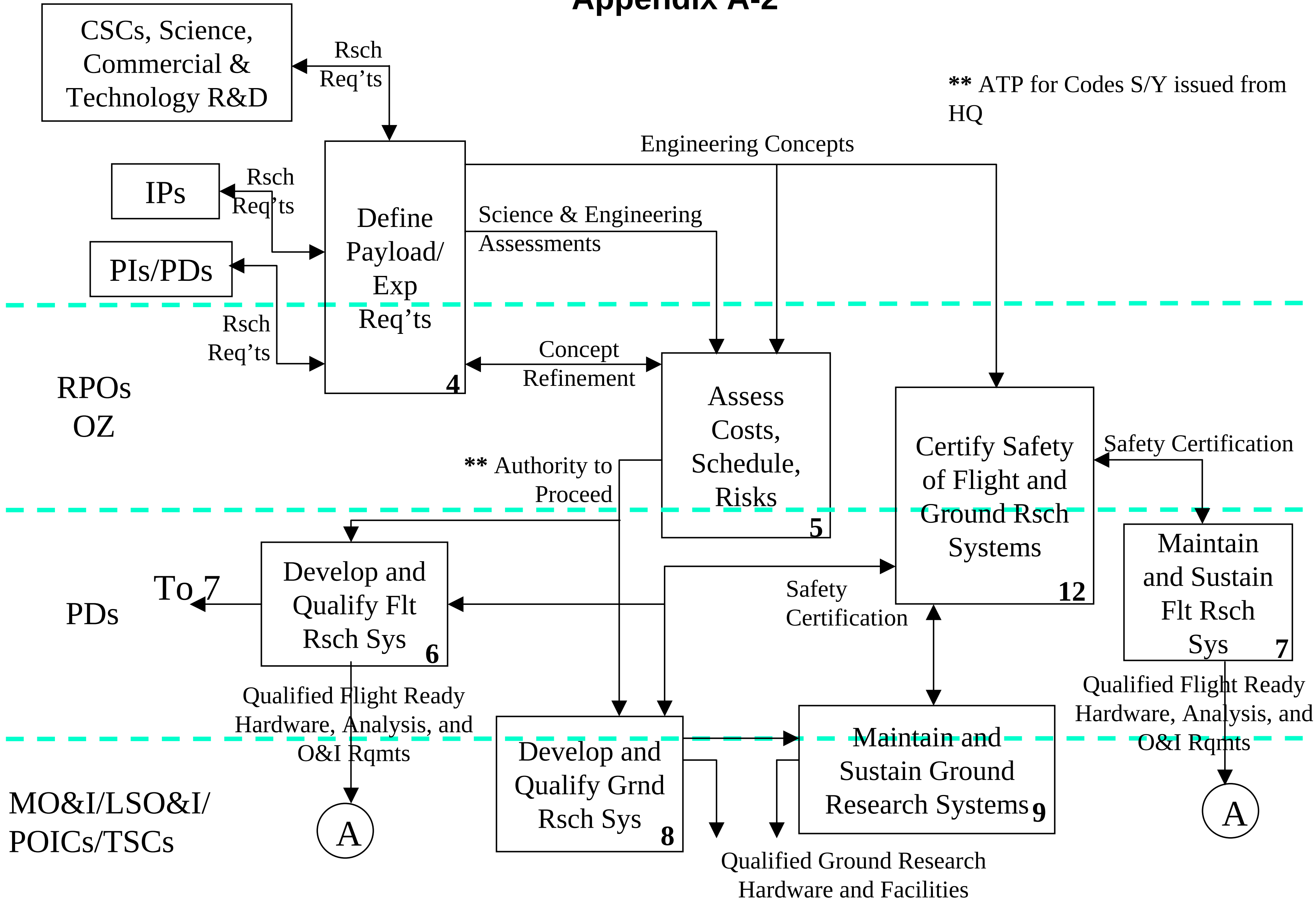


* ISSLSWG/IMSPG includes NASA HQ and IP Agency Science Leads with RPO Participants.
ISSLSWG/IMSPG does not evaluate Commercial Flight Requests.

Level 1 ISS Utilization Flow

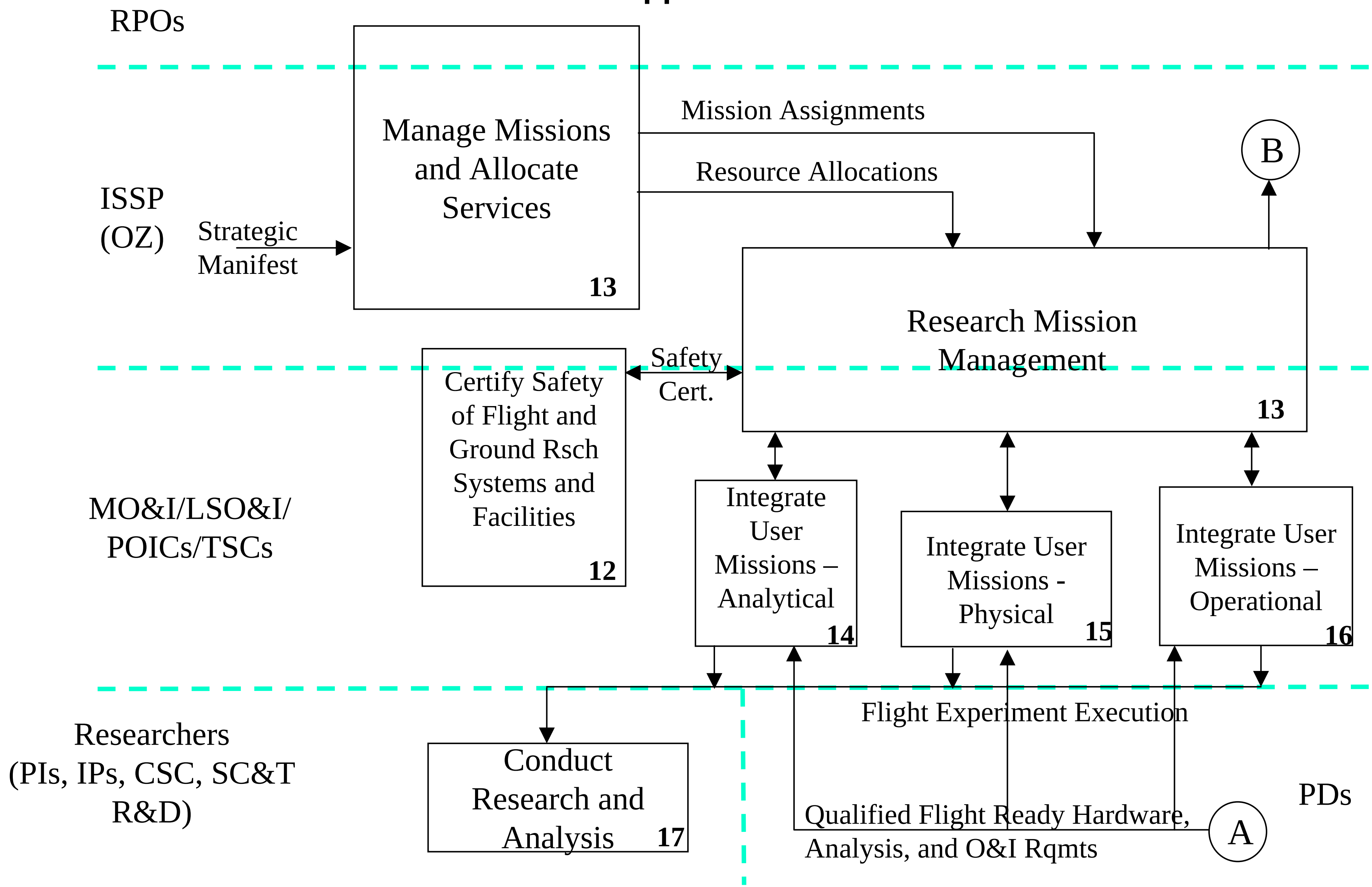
Post Experiment Selection

Appendix A-2



Level 1 ISS Utilization Flow
Post Manifest Selection

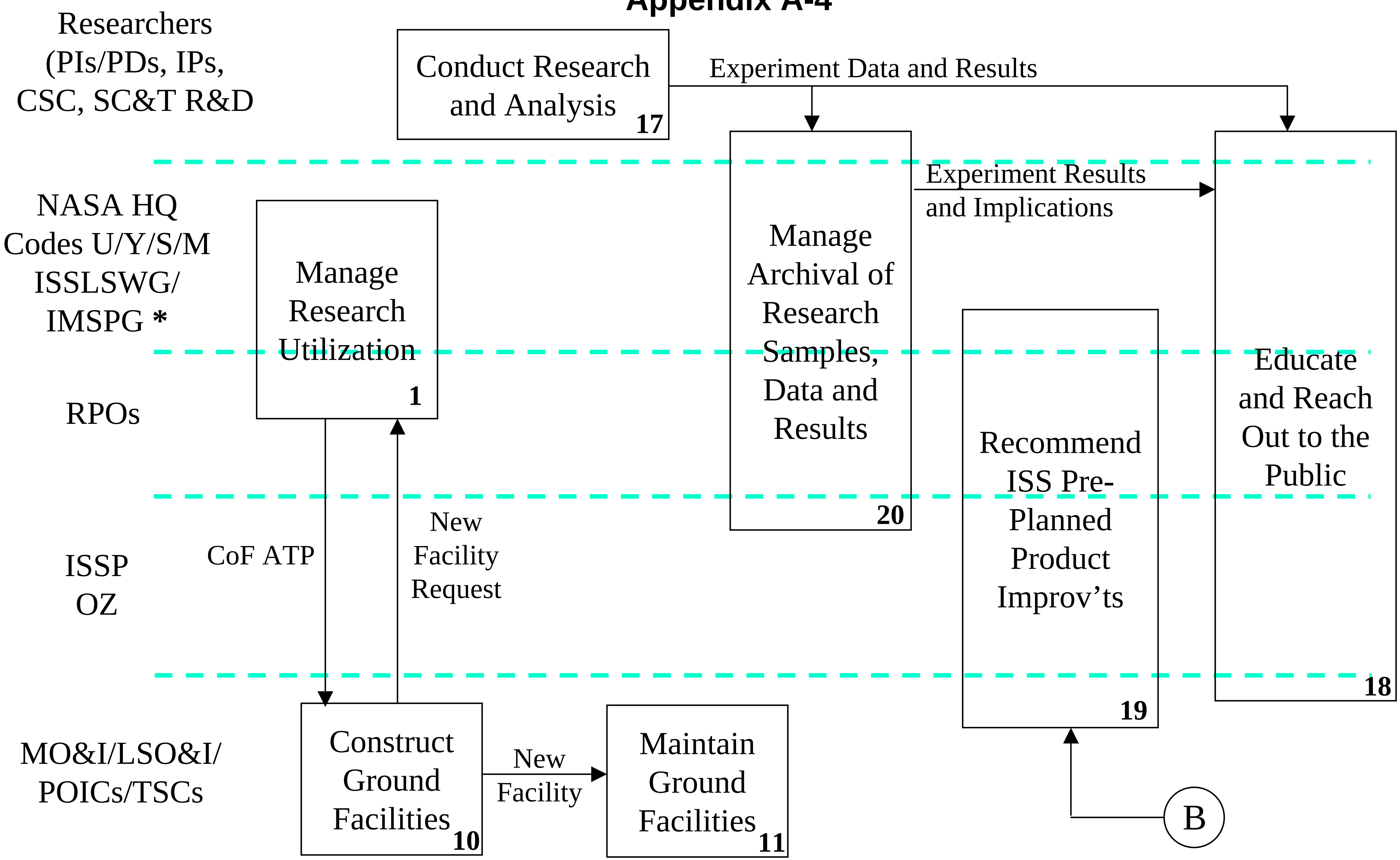
Appendix A-3



Level 1 ISS Utilization Flow

Non-Hardware Related Activities

Appendix A-4



* ISSLSWG/IMSPG includes NASA HQ and IP Agency Science Leads with RPO Participants.

Transaction Flow

Managing Missions and Allocating Services

Appendix A-5

HQ/RPOs

Management of Research Utilization (1)

- ISS Research Strategic Plan **(1a/b)**
- Integrated Research Management **(1c)**

Selecting and Prioritizing Research (3)

- Strategic/Tactical Research Priorities
- Payload Readiness Dates
- Increment Research Team Support

ISSPO (OZ)

- Individual Payload Developer **(6/7)**
  - Research and resource requirements
- ISS Program
  - Utilization Resource Allocations
- Space Shuttle Program
  - Orbiter capabilities
- International Partners
  - Partner research and resource requirements

Advocacy, Manifesting And Resource Allocations

13a

Increment Preparation

- Increment Research Requirements and Priorities
- NASA Payload Resource allocations
- Multilateral Utilization allocations

Increment Execution

- Lead Increment Scientist POIC Cadre Member
- Real-Time research calls
- Lead Increment Research Team
- Support to ISS Increment Mission Management Team

- Integrated Payload Operations **(16)**
  - Allocations and Priorities

ISS Research Mission Management

13b

- Payload Integration Requirement Document Blank Books
- Payload Integration Agreements
- Represent Payloads at ISS Flight and Increment Management Team
- Detailed Payload manifest and stowage

- Integrated Payload Certification of Flight Readiness Detailed Payload Manifest
- Inter-Partner agreement
- Shuttle MIP and MIP Annex inputs
- Represent Payloads at ISS Increment Mission Management Team

- Integrated Payload Analytical **(14)**
  - Topologies
- Physical Integration **(15)**
  - Special Services
- Integrated Payload Operations **(16)**
- Pre-Planned Product Improvement **(19)**
- International Partners
- ISS Program CoFR

Transaction Flow

Integrating User Missions - Analytical

Appendix A-6

Payload to locker/drawer and Pallet Adapter **(6a/7a)**

- H/W and S/W ICDs
- Verification products
- Safety Data Package
- Schematics and config/assembly drawings
- Maintenance, Sustaining and trouble shooting

ISS PDs

Facility Engineering **(6b/7a)** Subrack and Adapter Payloads to Rack and Pallet Engineering

ISSPO (OZ)

- Facility Hardware DDT&E
- Sub-Rack/Pallet to Facility Integration
  - H/W and S/W ICDs
  - Verification products
  - Integrated Safety Data Package
  - Schematics and config/assembly drawings
  - Integrated Engineering (by rack configuration)
    - Systems (Power, thermal, data, vacuum)
    - Disciplines (structures, acoustics, EMI/EMC)
- Facility Maintenance, Sustaining, and trouble shooting

14a/b

Rack and Full Truss Payload to Element Engineering

Element to ISS Level Engineering

- Payload Safety Review Panel (PSRP) **(12)**
- Mission Management **(13b)**
- Physical Integration **(15)**
- POIF/PSIV **(16b)**
- International Partners
- Vehicle Disciplines

- Mission Management **(13b)**
  - Payload Tactical Plan
- Research Management **(13a)**
  - Research Priorities
- ISS Vehicle
  - System Capabilities
- International Partners
  - Partner Element Capabilities

- Integrated Experiment Hazard Analyses
- Schematics and config/assembly drawings
- Integrated Engineering (by Flight)
  - Systems (Power, thermal, data, vacuum)
  - Disciplines (structures, micro-gravity, acoustics, contamination)
- Operational Guidelines and Constraints
- Software configuration files
- Real-time Engineering Support

Transaction Flow

Integrating User Missions - Operational

Appendix A-7

Individual Payload Operations **(6c/7b)**

- Payload Operations Data Set
- Payload Training Data Set/simulator(s)
- Payload Planning Data Set
- Ground Data Services Data Set

ISS PDs

Facility Operations **(6c/7b)**

Multi-Use hardware Operations

- Integrated Rack/Multi-Use Hardware Rack/Pallet Level System Operational Requirements
  – Procedures/displays/flight rules
  – Training
  – Planning

16a/b

ISSPO (OZ)

- S&MA/ PSRP **(12)**
- Mission Management **(13b)**
- Physical Integration **(15)**
- Mission Operations Directorate
- International Partners

Integrated Payload Operations: Increment Preparation

Integrated Payload Operations: Increment Execution

- S&MA/ PSRP **(12)**
  – Operational controls for hazards
- Research Management **(13a)**
  – Research Priorities
- Mission Management **(13b)**
  – Payload Tactical Plan
- Mission Operations Directorate
  – System OOS
  – Operational Standards
  – Shuttle joint operations
- International Partners
  – Partner OOS

- Payload Operations Data File (PODF)
- On-Orbit Operations Summary (OOS)
- Operational Safety Assessments
- Integrated Payload Training

- Procedure Updates (OCRs)
- Weekly Look Ahead and On-Orbit Short Term Plans
- Payload Anomaly Reports (PARs)
- Operational Safety Oversight

- TSCs, PI/PD **(17)**
  – Data Distribution
- Payload Operations **(7b)**
  – Commands & telemetry
- Mission Control Center Houston
- IP Control Centers

ISS Payload Ground Systems

9a/b

- Payload Data Library
- Payload Planning System
- POIC Work Station and Software
- Payload Data Services System
- Integrated Payload Network Requirements

- Hardware Leases
- Software licensing/ maintenance
- Data Base Administration
- Real-Time Facility/System Configuration Updates